Clinics of Surgery

Artificial Intelligence and Machine Learning in Oral and Maxillofacial Surgery: Ethical Issues and their Ramifications

Cameron Y. S. Lee[1*], DMD, MD, PHD, MPH, MSEd and Jon B. Suzuki, DDS, PHD, MBA[2]

[1]Private Practice in Oral, Maxillofacial and Reconstructive Surgery, Aiea, Hawaii. 96701, Professor of Adjunct Surgery. Temple University. Kornberg School of Dentistry. Philadelphia, USA

[2]Department of Periodontics. University of Maryland, Department of Graduate Prosthodontics, University of Washington, Department of Periodontics, Nova Southeastern University, Department of Microbiology, and Immunology, School of Medicine, Department of Periodontology and Oral Implantology, School of Dentistry, Temple University, Philadelphia, USA

*Corresponding author:

Cameron Y. S. Lee, DMD, MD, PHD, MPH, MSEd, Private Practice in Oral, Maxillofacial and Reconstructive Surgery, Aiea, Hawaii. 96701, Temple University. Kornberg School of Dentistry. Philadelphia, USA

Citation:

Lee CYS. Artificial Intelligence and Machine Learning in Oral and Maxillofacial Surgery: Ethical Issues and their Ramifications. Clin Surg. 2023; 9(6): 1-3

1. Introduction

As the authors of this paper have been in academia and private practice for over 30 years, we have witnessed the gradual introduction of artificial intelligence (AI) and machine learning (ML) that no doubt, will improve the health of our patients and health care services. Artificial intelligence is a special area of computer science where performance of tasks is accomplished that would normally require human intelligence [1]. But make no mistake, medicine and dentistry's most important element is the interaction between doctor and patient. This precious relationship must remain at the core of healthcare.

Machine learning is a part of computer science where the machine can imitate human-like behavior to complete tasks such as problem solution and decision making by learning from the input of data [2, 3]. Although we support this novel amazing technology, there are ethical issues and challenges of AI and ML. Ethical use of such leading-edge autonomous surgery must be guided by moral principles that provides patient safety, protects patient privacy, is transparent and accountable if the benefits are to be realized [4]. In this paper, the authors will address some of the key ethical issues and their ramifications regarding artificial intelligence and machine learning.

2. Algorithm Bias

Artificial intelligence and ML have the potential to contribute greatly to oral and maxillofacial surgery, particularly in the interpretation of anatomic imaging [5]. Algorithms with their vast amounts of data sets will deliver faster and more consistent diagnoses than surgeons and improve patient care. However, the use of algorithms does raise some ethical challenges. To decrease bias and increase patient beneficence, it is important that algorithms have data sets that accurately reflect a diverse patient population [6].

One variable that can create bias is using race [7]. Inserting race into algorithm data sets introduces race-based medicine. This could result in a reduction in healthcare resources to racial and ethnic minorities. Such algorithm bias may lead to inequitable patient care. For example, predicting the risk of cardiovascular events in non-white populations from the Framingham Heart Study resulted in biased results in underestimating cardiovascular risk [8]. There are many other examples of algorithm bias in medicine and surgery. To predict clinical risk in cardiovascular disease, a popular clinical tool using past health care costs was used by many health insurance companies. As most health care systems spend more money on White patients compared to Black patients, the clinical

tool summarized that White patients were at higher risk for cardiovascular disease. The results led to increased referrals of White patients to medical specialists compared to Black patients. Such algorithmic bias perpetuates race bias in healthcare [9].

3. Patient Data Privacy

As artificial intelligence systems will access substantial amounts of patient data, AI systems must not breach patient privacy and security requirements [10]. With patient information becoming automated, doctors are no longer the only repositories of medical knowledge. Key issues of data ethics include privacy and protection of data, informed consent, and ownership. Maintaining the privacy of patient medical data is of primary importance. Patient data must not be used in any way that could harm or discriminate against their patients at the expense of financial gain [11].

Bias caused by data occurs when the data distorts the truth. An example is when one demographic group does not accurately represent truth about a different group. Such bias can pose harm to diverse groups of people based on sexual orientation, gender, ethnic, economic, and social factors. Therefore, we need to ensure that AI is utilized equitably in the patient population.

4. Patient Safety and Accountability

Throughout their career, every surgeon will make a diagnostic error that will negatively affect the treatment outcome of their patient [12]. With any novel technology in healthcare, the most critical issue is if the technology functions as planned and will not harm the patient [13].

As surgeons have become increasingly dependent on technology, an ethical dilemma the surgeon is confronted with is how much machine autonomy can the surgeon rely on without increasing their risk and malpractice liability if the surgical robot makes an error. This is an important ethical issue if the patient is injured, or there is a poor surgical outcome and the surgeon was relying on AI to make the perceived best surgical treatment option, but such decision making was beyond the capability of the surgical robot [12]. Should AI and ML become part of standard everyday patient treatment, the ethical principles of beneficence and respect for patient autonomy will have to apply to machine learning and artificial intelligence.

5. Transparency

Artificial intelligence uses convolutional neural networks, often referred to as "black boxes". Trusting a black box creates moral decisions as algorithms are not always transparent [14].

Such black boxes may not provide a specific reason a particular decision was made and has proven to be problematic. Further, any lack of transparency will not generate trust with patients and their doctor. Increasing trust can be accomplished only with absolute transparency regarding how treatment decisions are selected. Although the doctor may never fully understand how AI algorithms arrive at a specific decision, trust can be gained by the doctor educating themselves about the fundamentals of AI.

Bias can also occur during construction of AI training models. As bioengineers who act as AI agents, they must carefully consider how bias will affect the algorithms and data used to train a model [15]. While constructing an AI algorithm bioengineers must be able to describe how all patient data sets will be used. As most AI algorithms have over 100 million data sets based on treatment strategies and statistical analysis, the ability of a machine to explain how it arrived at a specific decision in surgical treatment is no doubt, a challenging task. Because of the inability to explain the process of decision-making, patients and doctors may be hesitant to trust robotic surgery.

6. Conclusion

Whether artificial intelligence and machine learning is superior to the human surgeon and will replace them does raise some stimulating conversation. In our opinion, the patient-surgeon relationship will never be replaced by AI and ML but rather enriched by additional information. The surgery community must continue to develop strong ethical codes when using AI and ML. Such ethical codes must promote the common good in healthcare and respect the privacy and rights of all patients.

References

1. Hinton G. Deep learning- a technology with the potential to transform healthcare. JAMA. 2018; 320: 1101-2.

2. Kohli M, Prevedello LM, Flice RW, Geis JR. Implementing machine learning in radiology practice and research. AJR Am J Roentgenol. 2017; 1-7.

3. Hashimoto DA, Rosman G, Rus D, Meireles OR. Artificial intelligence in surgery: promises and perils. Ann Surg. 2018; 268: 80-76.

4. Anderson M, Anderson SL. Machine ethics: creating an ethical intelligent agent. AI Magazine (Winter). 2007; 15-26.

5. Rekawek P, Rajapakse CS, Panchal N. Artificial intelligence: the future of maxillofacial prognosis and diagnosis? J Oral Maxillofac Surg. 2021.

6. Erickson BJ, Korfiatis P, Akkus Z, Kline TL. Machine learning for medical imaging. Radiographics. 2017; 37: 505-15.

7. Burchard RG, Ziv E, Coyle N, Tang H, Karter AJ, Mountain JL, et al. The importance of race and ethnic background in biomedical research and clinical practice. N Engl J Med. 2003; 348: 1170-5.

8. Gijsberts CM, Groenewegen KA, Hoefer IE, Eijkemans MJC, Asselbergs FW, Anderson TJ, et al. Race/ethnic differences in the associations of the Framingham risk factors with carotid IMT and cardiovascular events. PLoS One. 2015; 10(7): e0132321.

9. Obermeyer Z, Powers B, Vogeli C, Mullainathan S. Dissecting racial bias in an algorithm used to manage the health of populations. Science. 2019; 366: 447-53.

10. Mittelstadt BD, Floridi L. The ethics of big data: current and foreseeable issues in biomedical contexts. Sci Eng Ethics. 2016; 22: 303-14.

11. Rajkomar A, Dean J, Kohane I. Machine learning in medicine. N Engl J Med. 2019; 380(14): 1347-58.

12. McGlynn EA, McDonald KM, Cassel CK. Measurement is essential for improving diagnosis and reducing diagnostic error: a report from the Institute of Medicine. JAMA. 2015; 314: 2501-2.

13. Barwell BSL-E. Legal liability options for artificial intelligence. Lexology. 2018.

14. Mirsky Y. Mahler T, Shelef I. CT-GAN: malicious tampering of 3D medical imagery using deep learning. 2019.

15. Gianfrancesco MA, Tamang S, Yazdany J, Schmajuk G. Potential biases in machine learning algorithms using electronic health data. MAMA Intern Med. 2018; 178: 1544-7.