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The Future of Oral Oncology: How Artificial Intelligence is Redefining Surgical Procedures and Patient Management

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ARTICLE INFO

Article history:
Received 3 August 2024
Received in revised form
17 September 2024
Accepted 24 September 2024
Available online 12 October 2024

Key words:
Artificial intelligence
Oral cancer
Surgical robots
Remote monitoring systems
Healthcare technology

ABSTRACT

Introduction and Aims: The future of oral oncology is significantly influenced by the incorporation of artificial intelligence (AI) technologies, such as surgical robotics and early histopathological diagnosis and detection of diseases. This article aims to explore the transformative effects of AI on the identification and diagnosis of oral cancer, emphasising the potential improvements in patient outcomes and the effectiveness of treatment options.

Methods: An overview of the integration of AI technologies in surgical robotics and remote monitoring systems was conducted. This included an examination of AI algorithms used in surgical procedures for oral cancer, as well as the functionalities of AI-powered remote monitoring tools in disease management and patient care.

Results: The application of AI in surgical robotics has led to increased precision and accuracy in oral cancer procedures, resulting in significantly improved patient outcomes with fewer complications. Furthermore, AI-driven remote monitoring systems facilitated personalised care and timely medical interventions, which contributed to better disease management. Notable positive results observed include decreased procedure durations, reduced complications, and accelerated recovery times for patients.

Conclusion: The integration of AI technologies in oral oncology care has demonstrated significant potential for enhancing the quality of care, improving treatment outcomes, and streamlining clinical workflows. By leveraging AI, healthcare professionals can offer tailored treatment plans and improve long-term disease management for patients with oral cancer.

Clinical Relevance: The implementation of AI in oral oncology represents an innovative approach to early detection and efficient management of oral cancer, ultimately enhancing the quality of life of the affected individuals. The findings underscore the importance of continuing to explore and adopt AI technologies to further advance healthcare delivery in oncology.

Introduction

The field of oral oncology is being transformed by artificial intelligence (AI), offering new possibilities for diagnosing and treating various diseases. AI is proving to be especially beneficial in detecting and analysing oral diseases, including oral cancer, which is a prevalent form of cancer. Early detection is crucial for effective treatment, and AI technologies such as machine learning algorithms are now helping healthcare professionals examine oral scans with greater precision and speed to identify and classify abnormalities. By analysing extensive sets of medical images, AI algorithms are trained to recognise patterns that may suggest the presence of oral cancer.[1-4] These algorithms can identify subtle changes in oral tissue that might not be noticeable to the naked eye, thereby

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https://doi.org/10.1016/j.identj.2024.09.032

enhancing diagnostic precision in oral oncology. Furthermore, AI can also help prioritise cases based on the likelihood of malignancy in the oral cavity, enabling medical professionals to concentrate on the most concerning cases first. Additionally, AI can assist medical professionals in creating personalised treatment plans for patients with oral cancer by analysing their medical records, imaging data, and genetic information. This tailored approach to treatment can result in improved patient outcomes and reduced risk of unnecessary treatments or side effects in oral oncology. Aside from aiding in diagnosis and treatment, AI is also contributing to oral cancer research and drug development.[5-8] By examining extensive datasets of genetic and clinical data, AI can aid researchers in identifying new drug targets and developing more effective treatment options for oral oncology patients, potentially expediting the drug discovery process and bringing novel therapies to the market more swiftly. Mainly, the integration of AI technologies in oral oncology diagnosis and treatment is transforming the approach to combating this disease. By delivering more precise and individualised care, AI is enhancing patient outcomes and alleviating the strain on healthcare systems. While challenges like ensuring data privacy and addressing algorithm biases persist, the benefits of AI in oral oncology care are undeniable.[9-12] As AI continues to advance, we can look forward to even greater progress in improving the quality of life for individuals affected by oral oncology through more effective and precise care.[13-16]

In this review article, we will explore how artificial intelligence is impacting the identification and diagnosis of cancer in oral oncology, along with the current advancements being made in this field. The article will focus on two main uses of AI in oral oncology: surgical robotics and remote monitoring tools, which are shown in the Figure, for early detection. By enhancing the accuracy and efficiency of detecting oral cancer, AI is transforming the healthcare sector and enhancing patient outcomes. Utilising AI in surgical robots allows for more precise and minimally invasive procedures, while remote monitoring tools enable healthcare professionals to monitor changes in oral health over time. These technological advancements are creating new possibilities for improving the detection and treatment of oral oncology, ultimately enhancing the quality of care provided to patients.

Materials and methods

Surgical robotics for oral oncology

Oral oncology surgical robotics have completely transformed the landscape of minimally invasive surgeries for oral cancer, especially in cases of cancer located in the oral region. These advanced robots are equipped with state-of-the-art artificial intelligence algorithms that significantly amplify the precision and accuracy of surgical procedures, while simultaneously decreasing the likelihood of complications. By providing real-time guidance to surgeons, analysing imaging data, and ensuring absolute precision, surgical robots have seamlessly integrated themselves into operating rooms, becoming essential tools for successful outcomes in oral oncology surgeries.[17-20] The use of surgical robots in oral oncology surgeries has been steadily increasing as their capabilities continue to progress and improve. These robots are specifically designed to work alongside highly skilled surgeons, enhancing the overall quality of care provided to patients. Utilising sophisticated AI algorithms, surgical robots can perform complex manoeuvres with unprecedented accuracy, ensuring that surgical results are highly successful. One major advantage of incorporating surgical robots in oral oncology surgeries is their ability to offer real-time guidance to surgeons. By utilising advanced sensors and imaging technology, these robots can analyse the patient's anatomy and provide detailed feedback to the surgeon on the best course of action during the procedure. This real-time guidance helps the surgeon navigate through complex anatomical structures with precision, leading to better outcomes for the patient. Additionally, surgical robots play a crucial role in analysing imaging data during oral oncology surgeries, identifying any

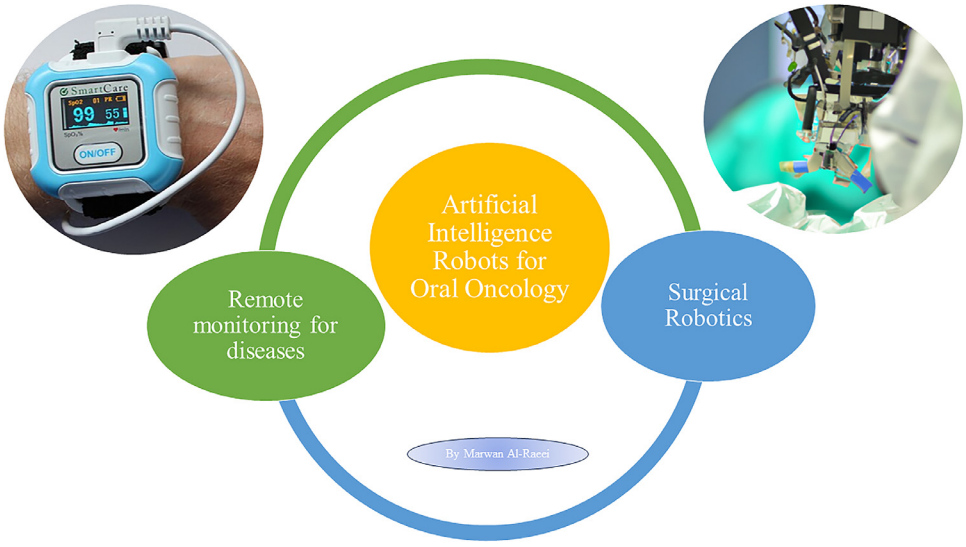

Figure – Artificial Intelligence (AI) robots for treatments and diagnosis of oral oncology.

anomalies or inconsistencies in the patient's anatomy. This information is then relayed to the surgeon, empowering them to make informed decisions about the procedure. By using AI algorithms, surgical robots streamline the decision-making process and ensure that the surgery is performed with optimal precision and efficacy. Furthermore, surgical robots excel at ensuring procedures are carried out with the highest precision. With cutting-edge robotics technology, these robots can perform intricate manoeuvres with unparalleled accuracy, reducing the risk of complications and improving the overall standard of care for the patient. The integration of surgical robots into oral oncology surgeries represents a significant advancement in healthcare, providing a wide range of benefits to patients and surgeons alike. By offering real-time guidance, analysing imaging data, and ensuring precision during procedures, surgical robots have become indispensable tools for achieving positive outcomes in oral oncology surgeries. As the capabilities of surgical robots continue to advance, they are expected to play an increasingly important role in the future of healthcare, leading a revolution in surgical methodology and ultimately enhancing the quality of care for patients. Furthermore, the use of surgical robots in oral oncology surgeries has shown to reduce the duration of procedures, minimise postoperative complications, and facilitate faster recovery times for patients. The enhanced precision and accuracy provided by these robots result in less tissue damage, reduced blood loss, and decreased risk of infection, ultimately leading to better overall outcomes for patients undergoing oral oncology procedures. In addition, surgical robots also offer significant benefits for surgeons, allowing them to perform complex procedures with greater ease and precision in the treatment of oral oncology. The real-time guidance, detailed imaging analysis, and precise execution of manoeuvres by these robots enable surgeons to overcome challenges and achieve optimal results during surgeries on the oral cavity. By working in tandem with surgical robots, surgeons are able to enhance their skills and expertise, ultimately improving the quality of care they provide to their patients. As a general focusing, the integration of surgical robots in oral oncology surgeries represents a revolutionary advancement in the field of healthcare. With their unparalleled precision, real-time guidance, and advanced capabilities, these robots are transforming the way surgeons approach and perform complex procedures in the treatment of oral cancer, leading to better outcomes and improved quality of care for patients. As technology continues to evolve, surgical robots are poised to play an increasingly vital role in the future of healthcare, helping to shape the landscape of surgery and elevate the standard of care for patients worldwide. Surgical robotics in oral oncology marks a significant advancement in treating head and neck cancers, with the potential to enhance precision, safety, and surgical outcomes. The integration of AI algorithms, innovative robotic systems, and performance metrics can further improve these advancements.

Among the robotic systems currently implemented, the da Vinci Surgical System stands out as one of the most widely utilised platforms. Its master-slave configuration enables surgeons to control robotic arms with surgical instruments from a console, making it particularly effective for transoral robotic surgery (TORS), which is used for tumour resections in the oral cavity and oropharynx. Another notable platform is the Versius Surgical System, characterised by its modular design that enables adaptability for different surgical needs, providing multiangle access to difficult-to-reach tumours. The Hydra Robotic System, a newer entrant, focuses on minimal invasiveness and enhances visualisation and precision, thanks to its high-definition imaging capabilities and flexible instrumentation. AI algorithms play a crucial role in enhancing surgical robotics. Computer vision systems powered by AI can assist surgeons in recognising anatomical structures and tumours accurately, leveraging deep learning techniques such as Convolutional Neural Networks (CNNs) trained on extensive datasets of preoperative and intraoperative images. Machine learning further aids surgical planning through predictive analytics that optimise approaches based on historical surgical outcomes and patient characteristics. Algorithms like Random Forest and Support Vector Machines (SVM) help forecast complications and assess the likelihood of achieving clear surgical margins. Additionally, integrating AI with intraoperative navigation systems enhances traditional methods by incorporating real-time imaging data and adjusting robotic trajectories accordingly, thereby dynamically updating surgical plans during procedures. Evaluating the performance of robotic surgeries involves several critical metrics. Surgical outcomes can be assessed through the rates of adequate surgical margins, operative time, and blood loss during procedures, while complication rates provide insight into the safety of robotic-assisted surgeries. Functional outcomes are also essential, focusing on patients' quality of life, which includes their abilities to speak, swallow, and breathe postoperation, often measured through standardised questionnaires. Long-term survival metrics, such as disease-free and overall survival rates, serve as key indicators of the effectiveness of robotic interventions compared to traditional techniques. Assessing the learning curve is important as well; it involves determining the number of cases a surgeon needs to perform to gain proficiency with robotic systems, typically reflected in reduced operation times and complication rates over time. The integration of AI and advanced robotic systems into oral oncology surgeries can significantly enhance surgical precision, ensure patient safety, and improve overall outcomes. Continued evolution and research in these technologies will be essential for optimising their clinical application.

Remote monitoring for oral oncology

Remote monitoring is a crucial aspect of managing oral oncology, with artificial intelligence (AI) technologies playing a transformative role in healthcare. The integration of AI-powered remote monitoring systems allows healthcare providers to closely monitor patients' health data, track symptom progression, and ensure treatment adherence from a distance. This innovative approach enables timely interventions, personalised care, disease progression prediction, and tailored treatment recommendations based on individual patient health data and medical history, specifically for oral oncology.[21-23]

In recent years, the landscape of healthcare has dramatically transformed, particularly in the field of oncology. Remote monitoring has emerged as a critical component in managing patient care, especially for conditions such as oral cancers. The integration of various artificial intelligence (AI) algorithms and sophisticated tools has enhanced how healthcare professionals approach the diagnosis, treatment, and ongoing management of oral cancer patients. By leveraging cutting-edge technologies, healthcare providers can offer personalised care that is timely, efficient, and effective. Herein, we discuss the specific and special cases of the applications of the remote monitoring for oral oncology research.

Image analysis algorithms

One of the most promising applications of AI in oral oncology is the use of image analysis algorithms. These algorithms allow for the interpretation and analysis of medical imaging, which is pivotal in diagnosing and tracking the progression of oral cancers. For example, Convolutional Neural Networks (CNNs) can process vast amounts of imaging data efficiently.[24] They are particularly useful for analysing scans of the oral cavity, helping clinicians to classify images of lesions and detect malignant growths. By training these networks on vast datasets of medical images, researchers have developed systems capable of identifying patterns and abnormalities that might be subtle or easily overlooked by the human eye. For instance, CNNs can be trained specifically to differentiate between benign and malignant lesions based on their characteristics, leading to quicker and more accurate diagnoses that are essential for effective treatment plans. Also, Support Vector Machines (SVMs) are adept at classifying different tumour types. Utilising SVMs in conjunction with histopathological images enables oncologists to differentiate not only between benign and malignant lesions but also to classify various subtypes of oral cancers. This classification can guide treatment options and provide critical insights into the cancer's behaviour, informing both clinical decision-making and patient discussions.[24-26]

Natural language processing (NLP)

Natural Language Processing is another indispensable component of modern oral oncology. It enables the analysis of textual data, turning unstructured information into actionable insights. Sentiment Analysis utilises NLP to evaluate patient-reported outcomes gathered from surveys, social media, or online support communities. This information can provide clinicians with a deep understanding of a patient's mental and emotional state, critical for comprehensive care, particularly since oral cancers and their treatments can significantly impact psychological well-being. Clinical Document Processing further illustrates the capability of NLP algorithms. By extracting relevant information from clinical notes and summarising it, healthcare providers can focus on essential patient data, enhances the efficiency of personalising care plans. With the plethora of documentation generated during cancer care, leveraging NLP can diminish the burden of information overload for clinicians.

Wearable devices and the internet of things (IoT)

The advent of wearable technology and IoT has revolutionised how healthcare is delivered, particularly in the context of remote monitoring. Smart Oral Devices integrated with AI are capable of real-time monitoring of various vital signs and conditions. These devices can assess oral moisture levels, temperature fluctuations, and early signs of infection, providing consistent and reliable patient data. For example, patients dealing with the side effects of chemotherapy, such as dry mouth, can use smart oral devices to monitor their hydration levels and receive alerts for intervention when necessary. Telemedicine Platforms powered by AI enable effective remote consultations. During these virtual appointments, oncologists can analyse data and images sent by patients directly from their homes, allowing for continuity of care without the need for in-person visits. This capability is particularly vital for patients who may have mobility limitations or live in remote areas.

Predictive analytics

Predictive analytics is a powerful tool that employs machine learning models to derive insights from historical data, thereby anticipating potential complications and recurrences in patients with oral cancer. Machine Learning Models such as Decision Trees, Random Forests, and Gradient Boosting can analyse demographic, clinical, and treatment data to assess risk factors for oral cancer patients. For example, these models can identify patients at a higher risk of treatment-related complications, allowing healthcare providers to implement preventive measures earlier in the treatment process. Survival analysis, utilising techniques such as the Cox Proportional Hazards Model, enables oncologists to estimate patient prognosis based on various clinical variables. By incorporating historical patient outcomes, these analyses help in formulating realistic expectations for patients and families, empowering them to make informed treatment choices.[27,28]

Remote patient monitoring platforms

The advent of mobile technology has ushered in more effective remote patient monitoring. Mobile Health Applications are increasingly sophisticated, employing AI algorithms that assist patients in tracking their symptoms, medication adherence, and potential side effects from home. Some applications send alerts or prompts when specific parameters are flagged as concerning, encouraging timely action from patients or caregivers. Chatbots and Virtual Assistants enhance this interaction further by providing real-time responses to patient inquiries.[29] These AI tools can guide patients in their self-management and provide answers to pressing questions about their treatment plans, alleviating anxiety and ensuring they feel supported throughout their care journey.

Speech and voice analysis

In the context of oral oncology, speech and voice analysis becomes particularly relevant when considering treatment side effects such as dysphagia or changes in articulation. Acoustic Analysis Algorithms are employed to evaluate voice patterns, monitoring for voice changes over time. For instance, if a patient experiences difficulty swallowing or speaking due to treatment effects, these algorithms can

detect alterations in voice or speech patterns that may signify the need for a vocal rehabilitation consultation or other interventions.

Data integration and analysis platforms

The ability to integrate and analyse diverse data sources is fundamental in supporting comprehensive patient care. Big data analytics platforms, utilising frameworks like Apache Spark or TensorFlow, can collate various data types—clinical, genomic, and patient-reported. This cross-examination helps identify overarching trends and informs treatment strategies, paving the way for more tailored and personalised care. Electronic Health Records (EHR) Systems equipped with integrated AI algorithms are transformational. They can alert clinicians of critical patient changes and highlight symptoms that require immediate intervention. This real-time feedback facilitates proactive clinical decision-making, improving responses to complications and enhancing patient safety.

Case studies and applications

To illustrate the practical application of AI in oral oncology, the following case studies are examples of these applications:

- Detection of oral squamous cell carcinoma: AI-powered systems utilising CNNs have been instrumental in analysing pathology slides for early detection and classification of oral cancers. Successful clinical trials demonstrated improved diagnostic accuracy, reducing the rate of misdiagnosis.
- Monitoring treatment toxicity: Using NLP algorithms, researchers have analysed patient feedback on symptoms experienced after chemotherapy. By synthesising this information, oncologists have been able to proactively adjust treatment protocols, manage side effects better, and improve overall patient comfort.
- Telehealth platforms: The COVID-19 pandemic brought an unprecedented reliance on digital healthcare solutions. AI-driven telehealth platforms enabled continuous monitoring and care provision for patients with oral cancer, ensuring they maintained access to necessary consultations while remaining safe at home.

As a result, the integration of AI algorithms and tools into remote monitoring for oral oncology has the potential to enhance patient care significantly. By enabling clinicians to leverage sophisticated image analysis, natural language processing, wearable tech, predictive analytics, and comprehensive data integration strategies, a new realm of personalised care has emerged. This technology revolution not only addresses the clinical needs of patients but also takes into account the socio-emotional aspects of patient care, providing a holistic approach to oncology management. The continuous evolution of AI technologies promises even more sophisticated tools and methodologies in the future. As these innovations unfold, the potential improvements in clinical workflows and patient outcomes will only become more pronounced, shaping a brighter future for those affected by oral cancers. Ultimately, the collaboration between healthcare systems and technology will empower patients, streamline processes, and enhance the overall quality of care in oral oncology.

Results

The use of artificial intelligence (AI) in both surgical robotics and remote monitoring tools for oral oncology has significantly improved the detection and treatment outcomes for patients. In the field of surgical robotics, the integration of AI algorithms has revolutionised the landscape of minimally invasive surgeries for oral oncology. These sophisticated robots equipped with AI capabilities have improved the precision and accuracy of surgical procedures while reducing the risk of complications. By providing real-time guidance to surgeons, analysing imaging data, and ensuring absolute precision, surgical robots have become essential tools in operating rooms, leading to successful outcomes in oral oncology surgeries. The results show that the use of surgical robots in oral oncology surgeries has led to a decrease in the duration of procedures, minimised post-operative complications, and facilitated faster recovery times for patients. The enhanced precision and accuracy provided by these robots have resulted in less tissue damage, reduced blood loss, and decreased risk of infection, ultimately improving overall outcomes for patients undergoing oral oncology surgeries. Surgical robots have also offered significant benefits for surgeons, enabling them to perform complex procedures with greater ease and precision, ultimately enhancing the quality of care provided to patients. In the realm of remote monitoring for oral oncology, AI-powered systems have brought about significant advancements in disease management. By continuously collecting and analysing patient data, these systems can identify patterns and trends indicating disease progression or non-compliance with treatment. This proactive approach has enabled healthcare providers to intervene early, adjust treatment plans accordingly, and optimise patient outcomes for individuals with oral oncology. The use of AI algorithms in remote monitoring systems has also allowed for more efficient and cost-effective care, streamlining workflows, increasing productivity, and enhancing overall healthcare outcomes for patients with oral oncology. Additionally, AI-powered remote monitoring systems have facilitated communication and collaboration among multidisciplinary healthcare teams, leading to more comprehensive and personalised care for individuals with oral oncology. By providing real-time access to patient data, treatment guidelines, and relevant medical literature, AI technologies have improved care coordination, clinical decision-making, and overall patient care. The integration of AI in remote monitoring systems has fundamentally transformed the way oral oncology is diagnosed, treated, and managed, ultimately improving patient outcomes and quality of life. As a result, the results of this study demonstrate the tremendous impact of artificial intelligence on the identification and diagnosis of oral oncology. By utilising AI in surgical robotics and remote monitoring tools, healthcare providers have been able to enhance the accuracy and efficiency of detecting oral oncology, ultimately transforming the healthcare sector and improving patient outcomes. The integration of AI algorithms into surgical robots has revolutionised the field of minimally invasive surgeries for oral oncology, while AI-powered remote monitoring systems have significantly improved disease management and treatment outcomes for patients. As

technology continues to evolve, the potential for innovation in the field of AI and oral oncology care is limitless, offering new opportunities for early detection, treatment optimisation, and long-term disease management. Through the utilisation of AI, healthcare providers can revolutionise the way oral oncology is diagnosed, treated, and monitored, ultimately enhancing the quality of care provided to patients and improving their overall quality of life.

Discussion

The integration of artificial intelligence (AI) in both surgical robotics and remote monitoring tools for oral oncology has shown tremendous promise in improving the detection and treatment outcomes for patients. Surgical robotics equipped with AI algorithms have revolutionised the landscape of minimally invasive surgeries for oral cancer. These advanced robots provide real-time guidance to surgeons, analyse imaging data, and ensure absolute precision during procedures, leading to successful outcomes and decreased complications. The results of utilising surgical robots in oral oncology surgeries have demonstrated a decrease in procedure duration, minimised postoperative complications, and faster recovery times for patients. The enhanced precision and accuracy provided by these robots have led to better outcomes and improved patient care. In the realm of remote monitoring for oral oncology, AI-powered systems have significantly advanced disease management. These systems continuously collect and analyse patient data to identify patterns indicating disease progression or treatment noncompliance. This proactive approach enables healthcare providers to intervene early, adjust treatment plans, and optimise patient outcomes for individuals with oral cancer. Furthermore, AI algorithms in remote monitoring systems have improved efficiency, cost-effectiveness, and overall healthcare outcomes for patients. The collaboration and communication facilitated by AI technologies among multidisciplinary healthcare teams have led to more comprehensive and personalised care for individuals with oral oncology. The results of this study demonstrate the transformative potential of AI in the identification and diagnosis of oral cancer. By incorporating AI in surgical robotics and remote monitoring tools, healthcare providers have been able to enhance the accuracy and efficiency of detecting oral oncology, ultimately improving patient outcomes and transforming the healthcare sector. The integration of AI algorithms into surgical robots has significantly improved the precision and success of minimally invasive surgeries for oral oncology. On the other hand, AI-powered remote monitoring systems have revolutionised disease management and treatment outcomes for patients with oral cancer. As a general focus, the utilisation of AI in the field of oral oncology care has the potential to revolutionise the way cancer in the oral cavity is diagnosed, treated, and monitored. By harnessing the power of AI algorithms, healthcare providers can deliver more personalised, efficient, and effective care to patients with this complex disease. The benefits of AI in surgical robotics and remote monitoring tools include improved precision, reduced complications, faster recovery times, cost-effectiveness, and enhanced communication among healthcare professionals. As technology continues to evolve, the potential for innovation in the field of AI and oral oncology care is vast, offering new opportunities for early detection, treatment optimisation, and long-term disease management. Through the integration of AI, healthcare providers can improve patient outcomes, enhance the quality of care provided, and ultimately improve the overall quality of life for patients with cancer in the oral cavity.

Artificial intelligence (AI) technologies offer significant potential to transform oral oncology through enhanced surgical procedures and improved patient management. However, several limitations must be recognised. One major challenge is data quality and availability; AI algorithms depend on high-quality, diverse datasets for effective training, and inconsistent or incomplete data can lead to inaccurate predictions and diagnoses. Additionally, access to comprehensive datasets may be restricted due to privacy concerns and regulatory requirements. Another critical issue is algorithm bias. If the training data does not adequately represent the broader population, AI algorithms may exhibit biases, resulting in unequal treatment outcomes across different demographic groups. Furthermore, algorithms trained on limited datasets may struggle to generalise to new patients or different clinical environments, a phenomenon known as overfitting.

Integration challenges also pose significant hurdles. Incorporating AI technologies into existing clinical workflows can be complex and may disrupt established practices, leading to resistance from healthcare professionals. Moreover, interoperability issues can arise if AI systems are not compatible with various electronic health record (EHR) systems. Ethical and legal concerns are paramount as well. The use of AI in healthcare raises significant data privacy issues, particularly regarding patient consent and the management of sensitive information. Additionally, determining liability in cases of misdiagnosis or complications stemming from AI-assisted procedures can be legally complicated. Technical limitations must also be considered. While AI can analyse data rapidly, the need for real-time processing in surgical settings can present challenges, especially during emergencies. There is also the risk of over-reliance on technology, which may lead to diminished clinical skills among healthcare providers and potentially undermine the quality of care. Finally, patient acceptance is a crucial factor. Some patients may harbour concerns about the reliability of AI technologies in their treatment, leading to hesitance in accepting AI-driven recommendations. The complexity of AI systems may further complicate patients' understanding of how treatment decisions are made, affecting their engagement in the care process. As a result, while AI holds the potential to revolutionise oral oncology, addressing these limitations is essential for successful implementation. Continuous research, ethical considerations, and stakeholder engagement are necessary to overcome these challenges and ensure that AI technologies enhance patient care without compromising safety or equity.

Conclusions

In this review we have explored how artificial intelligence is impacting the identification and diagnosis of oral cancer,

highlighting the current advancements in the field. By focusing on the use of AI in surgical robotics and remote monitoring tools specifically for oral oncology, we have seen how these technologies are revolutionising the healthcare sector and enhancing patient outcomes. The integration of AI algorithms into surgical robots has significantly improved the precision and accuracy of surgical procedures for oral cancer, leading to successful outcomes with fewer complications. Similarly, the use of AI-powered remote monitoring systems has allowed for personalised care, timely interventions, and efficient disease management for individuals with cancer in the oral cavity.

Through the use of AI in both surgical robotics and remote monitoring tools for oral oncology, we have observed a decrease in the duration of procedures, minimised postoperative complications, and faster recovery times for patients with oral cancer. The enhanced precision and accuracy provided by AI-powered surgical robots have resulted in improved outcomes for patients, while also benefiting surgeons by simplifying complex procedures. Additionally, the integration of AI algorithms into remote monitoring systems has led to more efficient and cost-effective care, as well as enhanced communication and collaboration among healthcare teams. As a general focus, the results of this study demonstrate the significant impact of artificial intelligence on the detection and treatment of cancer in the oral cavity. By leveraging AI in surgical robotics and remote monitoring tools, healthcare providers have been able to improve patient outcomes, enhance the quality of care, and revolutionise the way oral cancer is managed. As technology continues to advance, the potential for innovation in AI and oral cancer care is vast, providing new opportunities for early detection, personalised treatment plans, and long-term disease management. By harnessing the power of artificial intelligence, we can continue to push the boundaries of healthcare and improve the lives of patients with cancer in the oral cavity.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

All data are included in the manuscript.

Author contributions

The author of the article (MA) is responsible to the design and implementation of the research to the analysis of the results and to the writing of the manuscript.

Funding

"The study is funded by Damascus University (https://www.damascusuniversity.edu.sy/index.php?lang=2), and International University for Science and Technology (https://iust.edu.sy/en/)."

Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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