Editorial

How Can We Regulate the Use of Artificial Intelligence in Oro-Dental and Cranio-Maxillo-Facial HealthCare to Harness its Benefits while Avoiding the Pitfalls?

¿Cómo podemos regular el uso de la inteligencia artificial en los servicios de atención médica bucodental y craneomaxilofacial para aprovechar sus beneficios y evitar sus caídas?

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Abstract

Artificial Intelligence (AI) is advancing at an unprecedented pace and stands poised to reshape the landscape of healthcare, encompassing vital domains like dentistry, oral and maxillofacial surgery, and cranio-facial reconstruction. AI holds the potential to revolutionize these fields by enabling disease diagnosis, procedural planning, treatment administration, and patient rehabilitation. Yet, AI implementation is not without its challenges, as it introduces risks such as algorithmic bias, privacy concerns, and potential job displacement. The potential of AI within oro-dental and cranio-maxillo-facial healthcare is nothing short of transformative. It possesses the capacity to usher in a new era of patient care marked by enhanced precision, improved outcomes, and novel treatment approaches. However, to navigate this transformative journey responsibly and ethically, effective regulation emerges as the cornerstone. Through conscientious and purposeful AI regulation, we can confidently embrace the future of healthcare, wherein technology serves as an invaluable partner to the human touch, enriching the lives of patients, healthcare providers as well as academic and governing institutions alike.

Resumen

La Inteligencia Artificial (IA) avanza a un ritmo sin precedentes y está preparada para remodelar el panorama de la atención médica, abarcando dominios vitales como la odontología, la cirugía oral y maxilofacial y la reconstrucción cráneo-facial. La IA tiene el potencial de revolucionar estos campos al permitir el diagnóstico de enfermedades, la planificación de procedimientos, la administración de tratamientos y la rehabilitación de pacientes. Sin embargo, la implementación de la IA no está exenta de

desafíos, ya que introduce riesgos como sesgos algorítmicos, preocupaciones sobre la privacidad y un posible desplazamiento laboral. El potencial de la IA en la atención sanitaria bucodental y cráneo-maxilofacial es nada menos que transformador. Posee la capacidad de marcar el comienzo de una nueva era de atención al paciente marcada por una mayor precisión, mejores resultados y nuevos enfoques de tratamiento. Sin embargo, para recorrer este viaje transformador de manera responsable y ética, la piedra angular es una regulación eficaz. A través de una regulación concienzuda y decidida de la IA, podemos abrazar con confianza el futuro de la atención médica, en el que la tecnología actúa como un socio invaluable del toque humano, enriqueciendo las vidas de los pacientes, los proveedores de atención médica y las instituciones académicas y gubernamentales por igual.

Keywords: Artificial Intelligence; Regulation; Patient-Centered Care; Ethics; Patient Safety; Oro-Dental Healthcare; Cosmetic Surgery.

Introduction

The march of technology into healthcare is relentless, and artificial intelligence (AI) is at the forefront of this transformative wave. In the complex and highly specialized field of oro-dental and cranio-maxillo-facial healthcare, AI has shown remarkable promise, despite the scarcity and lack of literature, to date. Yet, it is highly probable that the remarkable image recognition capabilities of AI will soon lead to extensive integration and utilization in the recognition of dento-facial deformities. Indeed, it can aid in diagnostics, treatment planning, and even guide surgical procedures with unprecedented precision. However, this promise comes with its share of challenges and potential pitfalls, making regulation a paramount concern. This editorial explores the intricate task of regulating AI in this field to warrant that its benefits are harnessed while its pitfalls are skillfully avoided.

The Promising Potential of AI in Oro-Dental and Cranio-Maxillo-Facial Healthcare AI, armed with its capacity for rapid data analysis and pattern recognition, has begun to revolutionize oro-dental and cranio-maxillo-facial healthcare. It contributes to enhancing the accuracy of diagnosis, aids in the personalization and customization of treatment plans, and can even provide real-time assistance during surgeries. For instance, AI can analyze complex medical images to detect minute irregularities that might escape the human eye. Further, its ability to process vast amounts of data, renders AI an invaluable tool for treatment outcome prediction and tailoring interventions to the individual patient.

Applications of AI in Dentistry, Oro-Dental and Cranio-Maxillo-Facial Surgery AI is, can and will be used in dentistry, maxillo-facial and jaw surgery, and orthognathic reconstruction, correction, and rehabilitation in various ways, including (yet not limited to):

- *Diagnosis*: AI can be used to diagnose dental caries, periodontal conditions, oral cancer, and other oral and dental diseases.
- *Planning*: AI can be used to plan dental procedures, such as tooth extractions and implants, with accuracy and precision.
- *Treatment*: AI and AI-powered robots can be used to deliver precise dental treatments, such as functional and aesthetic fillings and crowns.
- *Rehabilitation*: AI can be used to rehabilitate patients who have suffered from oral injuries or diseases, with personalized orthotic devices designed to improve function.
- *Image analysis*: AI can be used to analyze medical images rapidly and sensitively, such as X-rays and CT scans, to better identify abnormalities and help plan treatment.
- *Data mining*: AI can be used to mine large datasets of patient(s) data to identify patterns and trends that can be used to improve diagnosis and treatment.
- *Decision support*: AI can be used to provide decision support to dentists and surgeons, such as by recommending treatment options or identifying potential risks.

Challenges and Pitfalls With the accruing integration of AI into healthcare, challenges and concerns about data privacy, potential bias in algorithms, and the risk of overreliance on technology loom large. High-profile cases of AI-based medical errors and privacy breaches have underscored the importance of responsible implementation and is a hot topic of ongoing controversy and debate, in major think-tanks and symposia, World-wide.

The Importance of Regulation Given these challenges, robust regulation becomes imperative. Regulatory bodies, ethical guidelines, and industry standards must work in concert to shape AI's role in oro-dental and cranio-maxillo-facial healthcare, similar to other fields. Herein, these regulations should carefully address issues of *transparency*, *explainability*, and *accountability* in the development and deployment of the AI algorithms.

Balancing Innovation with Patient Safety As we navigate the regulatory landscape, we also must be aware to strike a balance between fostering innovation and ensuring patient safety. Research, rigorous clinical trials, and close transparent collaboration between healthcare professionals and AI developers can help achieve this equilibrium.

Proposed Regulatory Framework A proposed regulatory framework should prioritize transparency in AI algorithms, as aforementioned. It requires developers to explain how AI makes decisions, especially in critical healthcare scenarios. Accountability measures should hold developers responsible for the performance of their AI systems. Herein, **Ethical AI** usage should be emphasized in all stages of development and implementation.

Patient-Centered Care Ultimately, the success of AI in oro-dental and cranio-maxillo-facial healthcare hinges on patient-centered care (and acceptability/adaptation/training of healthcare providers). Informed consent, patient education, and shared decision-making should be at the forefront of AI-driven healthcare decisions. Hence, patients must have agency in their care and understand well the role AI plays in their diagnosis and treatment.

To summarize, the regulation of AI in dentistry and its related specialities is still evolving. Therefore, some of the key considerations for safely regulating AI in these areas include:

- The level of regulation should be proportionate to the risk posed by the AI system. For example, AI systems that are used to diagnose and treat diseases may need to be regulated more strictly than AI systems that are used for marketing or administrative purposes.
- The regulation should be flexible enough to accommodate the rapid pace of innovation in AI. As AI technology continues to evolve, it is important to ensure that the regulatory framework is able to keep up.
- The regulation should be international in scope, as AI systems are often used across borders. This will help to ensure that patients and healthcare providers are protected, regardless of where they are located.

- The regulation should be developed in consultation with stakeholders, including dentists, surgeons, patients, industry, and governing representatives. This will help to ensure that the regulation is fair and effective.

All the above will also impact the associated costs, which are not to be underestimated.

Conclusion

The regulation of AI in dentistry, cosmetic surgery and face medicine is a complex and evolving issue. However, by carefully considering the key principles and considerations outlined herein, we can contribute to developing a regulatory framework that will help to ensure that this emerging and rapidly growing technology is used to improve our patient care and treatment outcomes. The potential of AI in oro-dental and cranio-maxillo-facial healthcare is undoubtedly immense. It has the power to revolutionize the field, patient care, enhance treatment plans and decision-making processes, improve outcomes, augment therapeutic and interventional predictability, and enhance the precision of procedures (and evaluation during and after surgery). A surgical AI-powered machine/robot can also perform time-consuming or challenging tasks for surgeons. Henceforth, responsible regulation is the linchpin that ensures this transformation occurs safely and ethically. Cost-effectiveness and fair accessibility should be also considered. Academic institutions alongside national healthcare systems can play a leading role in determining this before implementing AI widely. By regulating AI effectively, we can confidently embrace the future of healthcare, where technology and translational innovation augments the healing touch, quality of life, longevity, and the pursued smiles.

Final Thought / Closing Remark

In closing, we need to remember that the journey toward effective AI implementation, integration and regulation in healthcare is a collaborative one. It requires healthcare professionals, AI developers, policymakers, and patients to come together in dialogue and cooperation. Universities and R&D&I centers can shape a future where AI empowers the highest standard of patient care, guided by ethics, and grounded in patient well-being.

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