



LETTERS TO THE EDITOR:

Artificial Intelligence in Periodontology: Innovation or Overdependence?

Ingeniería artificial en periodoncia: ¿innovación o excesiva dependencia?

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Since Harald Löe's landmark discovery in 1965 demonstrating the association between bacterial plaque and periodontal disease, the diagnosis of gingivitis and periodontitis has traditionally relied on comprehensive history-taking and clinical examination performed by the clinician (1). However, in the current era, this is no longer the sole approach. Artificial intelligence (AI) has advanced considerably in modern dentistry, particularly in periodontics, in recent years. Some clinicians view AI as a powerful tool capable of providing rapid and reliable diagnostic support. Nevertheless, an important question remains regarding the appropriate integration of AI into clinical decision-making and the possibility of excessive dependence on automated systems.

In the field of periodontics, AI has already been widely explored for various diagnostic applications. For instance, convolutional neural network (CNN)-based systems have been used to detect alveolar bone loss on orthopantomograms (OPGs). Studies have demonstrated that these AI deep learning models are capable of producing findings comparable to those of experienced clinicians (2). Similarly, Wimalasiri *et al.* (3) reported that trained CNN models utilizing intraoral radiographs were not only able to identify alveolar bone loss but also differentiate between horizontal and vertical bone loss patterns.

Periodontal diagnosis is a crucial component in delivering personalized treatment. Current clinical practice guidelines for periodontal disease management emphasize staging and grading to support indivi-

dualized treatment planning (4). In this context, AI has emerged as a promising adjunctive tool for automated periodontal staging and grading, with future systems potentially integrating both clinical and radiographic findings (5). In addition, AI-assisted systems may improve diagnostic efficiency, support large-scale screening, and enhance consistency in radiographic interpretation, particularly in areas with limited specialist availability (2).

However, it is important to recognize that the integration of AI into the conventional “manual” approach of diagnosing and managing periodontal patients remains far from perfect. Several issues require further clarification and investigation before AI can be incorporated as a standard component of periodontal care.

First, ethical and medico-legal concerns must be carefully addressed (6). When patient information is entered into AI systems for machine learning purposes, there is a potential risk of data breaches, particularly if the system is compromised or accessed by unauthorized individuals. These events may jeopardize patient confidentiality and cause concerns about data security, consent, and accountability.

Secondly, although AI may provide valuable analytical support, it cannot fully replicate humanistic, ethical, and patient-centered considerations involved in clinical decision-making. In reality, the concept of “one size fits all” does not exist in periodontology. For example, after integrating clinical and radiographic findings, an anterior tooth may be classified by an AI system as “hopeless” and recommended for extraction. However, clinicians recognize that, with appropriate periodontal therapy and excellent patient compliance, the same tooth may still be preserved for a considerably longer period. Such scenarios

highlight the importance of ensuring AI-assisted tools are used alongside comprehensive clinical judgment rather than as standalone decision-making systems. Excessive reliance on automated systems may potentially reduce opportunities for clinicians to further develop critical diagnostic reasoning and individualized treatment planning.

Thirdly, there is still a lack of global validation among periodontists regarding the use of standardized AI systems for periodontal diagnosis and treatment planning. Existing research often includes heterogeneous datasets and different population groups, leading to different findings and limiting the generalizability of AI models. To address this limitation, future research should employ standardized methodologies and datasets on a larger scale, involving not only multicentre collaboration but also worldwide participation. Furthermore, the deep learning inputs or the “training data” provided to AI systems must take into account the diverse cultural, ethnic, and demographic backgrounds of populations worldwide. Such inclusivity is essential to ensure that AI-based systems are accurate, reliable, and applicable across different clinical settings (7). Only then can an international consensus on standardized AI tools be appropriately established through forums such as the World Workshop of Periodontology.

Perhaps the most concerning issue relates to education and clinical training for the younger generation. Young dentists, particularly those aspiring to become periodontists, may experience reduced exposure to traditional chairside teaching as AI becomes increasingly integrated into clinical practice. Traditionally, periodontal education emphasizes careful assessment of detailed clinical findings such as bleeding on probing, probing pocket depth, and gingival inflammation, and correlating these with radiographic features such

as alveolar bone loss and widening of the periodontal ligament space. A treatment plan will be formulated only after comprehensive interpretation of these findings. However, if clinicians are trained to trust AI systems by entering patient data and accepting the automated outputs without discussion and reasoning, the educational value of clinical mentorship may potentially be reduced. Consequently, younger clinicians may have fewer opportunities to develop critical thinking, diagnostic reasoning, and sound clinical judgment through direct interaction with experienced specialists.

Lastly, we believe that future research on the application of AI in periodontics should place greater emphasis on the humanistic and clinical aspects, rather than focusing solely on technological advancement. AI has significant potential to serve as a valuable adjunctive tool in periodontal practice; however, it should be used to complement, not replace, the clinician's expertise, judgment, and patient-centred approach to care.

CONFLICT OF INTEREST: Nil.

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