

How Can Artificial Intelligence Shape the Future of Dentistry and Periodontology While Preserving the Human Touch?"

Artificial intelligence (AI) is often negatively associated with addictive technologies like social media, yet its potential for enhancing patient-centered periodontal care is both promising and transformative. AI-powered mobile applications combined with smart toothbrush technologies can significantly improve oral hygiene awareness and long-term compliance among periodontal patients (Maini et al., 2025).

In clinical practice, I notice that patients often struggle to understand and remember hygiene instructions given during consultations. A dentist I collaborate with, addresses this by integrating the Oral-B IO toothbrush app into his practice. By allowing patients to share brushing data, he creates transparency and open communication. This reinforces trust and helps personalize care. His role remains vital, since AI models can sometimes produce overly broad interpretations, while clinical decisions often depend on subtle human insights and nuances.

But the true potential of AI extends far beyond current applications. Imagine a future in which each patient has a fully personalized dental health profile based on data collected and analysed by AI, seamlessly integrated into existing dental software packages. This comprehensive profile consolidates all relevant patient-specific variables, including:

- Genetic predisposition for periodontal diseases
- Brushing and interdental cleaning behaviors
- Nutritional and lifestyle factors
- Smoking status and alcohol consumption
- Stress levels and their impact on periodontal conditions
- Clinical history of inflammation and previous treatment responses
- Biomarkers from saliva tests indicating inflammation or bacterial activity
- Blood-test results providing insights into systemic health factors
- Radiographic images analyzed by AI stored for accurate comparisons over time

By synthesizing these variables into one coherent overview, dental professionals gain unprecedented personalized insight, significantly enhancing clinical decision-making and individual care planning. Furthermore, integrating various test results transforms this dental profile into a comprehensive medical representation of each patient, facilitating collaboration between dental and medical professionals. Additionally, this extensive dataset holds great promise for scientific research, enabling the identification of causal factors underlying periodontitis and related systemic conditions.

From personal experience, I know how challenging it can be for dentists to fully grasp and consistently track a patient's individual habits and risk factors. Information often exists but is fragmented across various sources making comprehensive assessment unmanageable. Centralizing these data into an AI-driven personalized dental-medical profile would streamline patient evaluations, allowing practitioners to effectively tailor preventive strategies to individual patient needs.

Predictive AI analysis could leverage patient-specific data to anticipate risks of periodontal disease or recurrence. This enables targeted preventive interventions even before clinical symptoms appear. AI-analyzed saliva testing could further refine this process by identifying biomarkers associated with inflammation or bone loss, providing early and accurate diagnostics of periodontitis. Additionally, storing and comparing radiographic images over time through AI-enhanced analysis ensures precise monitoring of disease progression or resolution (Shan et al., 2021).

Ethically, AI must complement rather than replace the human element in care. Dentists and specialists retain ultimate oversight to ensure that patient-specific recommendations remain clinically valid and safe. Professional judgment and empathy are essential to maintaining trust and delivering high-quality periodontal care. This is important because some patients may struggle more with accepting errors made by technology than those made by humans. Factors such as cultural background and age can strongly influence this perception.

Caution remains necessary to prevent over-reliance on technology; insights generated by AI require validation by experienced clinicians. Nevertheless, integrating AI-based personalized dental profiles within established clinical software represents a powerful innovation, substantially elevating periodontal care's quality, efficiency, and personalization.

In conclusion, innovative AI applications such as fully personalized dental-medical profiles and advanced biomarker analyses represent significant advancements in periodontal care. By harnessing AI's precision alongside indispensable human expertise, dentistry can achieve unprecedented personalized care, fostering trust and improving long-term periodontal health outcomes.

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