Artificial Intelligence (AI) in Periodontal Diagnosis

Victoria Hardwick, DDS

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Diagnostic Challenges

- Periodontal diagnosis remains operator-dependent
- Early bone loss detection is inconsistent
- Radiographic interpretation varies among clinicians
- Need for standardized, reproducible diagnostic tools

Sources: Azhari et al., *Front Dent Med* 2026; Patil et al., *JADA* 2023

AI Technologies Used in Perio Diagnosis

- Convolutional Neural Networks (CNNs): landmark detection, bone level measurement
- Segmentation models: tooth/bone/implant isolation
- Multimodal AI: radiographs + systemic data + history
- Explainable AI: heatmaps, saliency maps

Sources: Krois et al., *Sci Rep* 2019, Schwendicke et al., *J Dent Res* 2020

What AI Actually Does

- Detects CEJ, alveolar crest, and bone levels
- Segments teeth, bone, implants
- Identifies potential defects
- Quantifies bone loss over time
- Predicts progression risk

Source: Krois et al., *Sci Rep* 2019

AI: Radiographs

- CNNs achieve (Area under the curve) AUC >0.88 for periodontal bone loss detection.
  - AUC > 0.8 → considered good, AUC > 0.9 → considered excellent
- High sensitivity for early crestal changes
- Performance comparable to general dentists
- Strong reproducibility across repeated measurements

"You're Perio Education Sidekick: Detecting and Treating Periodontal Disease with AI" (Overjet) 10 min video

https://www.youtube.com/watch?v=PYwXd1bIFTY&utm_source=copilot.com

Sources: Ryu et al., *Appl Sci* 2023; Cassiano et al., *Clin Oral Investig* 2025; Lee et al., *J Periodontal Res* 2022

AI: CBCT

- Automated segmentation of teeth and alveolar bone
- Volumetric bone loss quantification
- Detection of intrabony defects, furcations, fenestrations
- Higher diagnostic accuracy than panoramic-based models

Source: Kurt-Bayrakdar et al., *Dentomaxillofac Radiol* 2025

AI in Peri-Implant Disease Detection

- Identifies early peri-implant radiolucencies
- Measures marginal bone loss with high reproducibility
- Differentiates physiologic remodeling vs pathology
- 3D defect morphology mapping in CBCT

"Discover the Future of Dentistry with Pearl AI | IDS 2023 Interview"
https://www.yalha.ai/?utm_source=copilot.com (Can request a demo)

Sources: Patil et al., *JADA* 2023; Kurt-Bayrakdar et al., *Dentomaxillofac Radiol* 2025

AI: Periodontal Charting

- Smart probes standardize probing force
- AI flags improbable measurements
- Voice-activated charting improves workflow efficiency
- Computer vision for bleeding detection (emerging)

Alta AI - Hands-free periodontal charting and AI-assisted radiograph interpretation.

https://altavoice.ai/?utm_source=copilot.com

Sources: Schwendicke et al., *J Dent Res* 2020; Azhari et al., *Front Dent Med* 2026

AI: Predictive Analytics

- AI integrates:
  - Radiographic bone patterns
  - Systemic factors (diabetes, smoking)
  - Historical response to therapy
  - Biomarker/microbiome data (research phase)
- Outputs:
  - Tooth-level risk
  - Patient-level progression probability
  - Suggested maintenance intervals

Source: Patil et al., *JADA* 2023

Evidence Quality & Limitations

- Moderate-to-high diagnostic accuracy across studies
- CBCT-AI strongest for 3D defect characterization
- Evidence remains heterogeneous
- Limited external validation
- Need for standardized reporting (STARD-AI, TRIPOD-AI)

Sources: Azhari et al., *Front Dent Med* 2026; Patil et al., *JADA* 2023

Summary

- AI improves consistency, measurement, and documentation
- Best-supported application: radiographic bone loss detection
- CBCT-AI is a powerful emerging adjunct
- Predictive analytics promising but early
- Periodontists remain the clinical decision-makers

Source: Schwendicke et al., *J Dent Res* 2020

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