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THE ROLE OF CLINICAL IMAGING IN MANAGING PERIODONTAL PATIENTS

Introduction

Periodontal diseases remain one of dentistry's most persistent challenges. Successful treatment outcomes require precise diagnosis, targeted treatment, and continuous monitoring—all of which depend on seeing below the surface. While full periodontal assessment, including probing depths and bleeding on probing, provides essential clinical data, imaging techniques, such as radiography, commonly used in dentistry, reveal the architecture and pathology hidden beneath the gingiva.

For dental hygienists and therapists, who are often at the front line of periodontal management, a strong grasp of imaging modalities is crucial. From periapical radiographs to intraoral scanning and 3D visualisation, imaging enhances understanding, accuracy and communication throughout every phase of care.

Why Does Imaging Matter?

Imaging bridges the gap between clinical observation and anatomical reality. It helps confirm suspected bone loss, identify local contributing factors, such as calculus or overhanging restorations, and aids the planning of effective interventions. Just as importantly, imaging supports patient engagement: showing patients their radiographs or photographs often transforms abstract discussion into tangible understanding. Still, the guiding principle remains as low as reasonably achievable. Each image must be clinically justified and acquired using optimized exposure protocols.

Conventional Two-Dimensional Imaging

Periapical Radiographs

Periapical radiographs remain the preferred standard for detailed evaluation of alveolar bone and root morphology in patients suspected of suffering from periodontitis. Standardised holders and parallel technique ensure reproducibility, allowing accurate comparisons over time.[1,2]

Limitations include:

- Superimposition of buccal and lingual bone plates
- Projection errors leading to distortion
- Low sensitivity to early mineral loss (<30%)

Despite these drawbacks, periapical images are the most accessible and cost-effective tool for assessing bone levels and interproximal morphology.

Bitewing and Vertical Bitewing Radiographs

Vertical bitewings extend the field of view to include more of the alveolar crest, making them ideal for moderate to severe periodontitis. When taken at consistent intervals, especially for interproximal caries detection, they serve as reliable longitudinal records of bone stability.

Panoramic Imaging

Panoramic radiographs (OPGs) provide a broad overview of both arches, revealing patterns of generalised bone loss, furcation involvement, and anatomical proximity to the maxillary sinus or mandibular canal. Although less detailed than intraoral films, they are useful for baseline screening and patient education.

"A good radiograph not only aids diagnoses—it documents history and progress."

Clinical Photographs: The Visual Record

Clinical photography has evolved from a "nice-to-have" to an essential diagnostic and documentation tool. High-quality, standardised images allow clinicians to track soft-tissue conditions, plaque levels and inflammation visually complementing radiographic findings.

Standardisation (consistent lighting, angulation, and magnification) is crucial. Comparing sequential photographs enables visual monitoring of tissue healing, aesthetic outcomes, and mucogingival changes. Moreover, photographs are compelling educational tools. Patients often respond more strongly to visible proof of progress than to clinical indices alone.

Intraoral Scanning: Digital Periodontal Mapping

Intraoral scanning (IOS) has moved well beyond restorative dentistry. For periodontal care, it offers a dynamic 3D record of the patient's dentition and soft tissues without impression material or radiation.

Key benefits include:

- Recording baseline gingival contours and recession

- Monitoring volumetric soft tissue changes post-therapy
- Overlaying sequential scans to measure tissue gain or loss
- Combining IOS data with radiographs or Cone-Beam Computed Tomography (CBCT) for hybrid hard/soft-tissue analysis

Digital models also improve patient understanding: showing gingival recession or bone loss on a 3D rendering often leads to greater motivation and compliance. Emerging research suggests IOS could become the gold standard for monitoring mucogingival stability and surgical outcomes.

Three-Dimensional Imaging: Expanding the View

Cone-Beam Computed Tomography (CBCT)

CBCT provides a volumetric view of alveolar bone, allowing precise visualisation of buccal and lingual defects, dehiscence and furcation involvement that 2D imaging cannot reveal.[1,3]

Clinical indications include:

- Assessing infrabony and furcation defects
- Planning regenerative or resective procedures
- Evaluating bone morphology before implant placement
- Clarifying equivocal 2D findings

Small-field CBCT scans minimise radiation while offering detailed, cross-sectional insight. The clinician must, however, interpret scans cautiously as artefacts, metallic restorations, and soft-tissue limitations can obscure detail. It is important to note that CBCT is not indicated as a routine method of imaging periodontal bone support.

Emerging Imaging Modalities

Outlined below are a few imaging tools that may gain traction in future clinical use: [4,5]

- Ultrasonography – non-ionising, useful for gingival thickness and alveolar crest measurements
- Magnetic Resonance Imaging (MRI) – Excellent soft-tissue contrast, limited by cost and metal artefacts
- Tuned Aperture CT (TACT) – Produces low-dose tomographic images through computational reconstruction
- Mixed-Reality Visualisation – Experimental holographic displays of 3D imaging data for surgery and education

Although many remain research tools, these innovations signal a future of less invasive, more integrated imaging.[4,5]

"The future of periodontal imaging is intelligent, digital, and three-dimensional."

Integrating Imaging Through the Phases of Care

Clinical imaging techniques can be applied at different stages of a patient's care. Some key points of use include:

- Diagnosis and risk assessment
- Confirming bone loss, defect patterns, and local factors
- Using photographs and IOS to record soft-tissue health and architecture
- Employing panoramic or periapical radiographs for initial assessment; only consider CBCT when 2D images are inconclusive
- Care planning
- Evaluating defect morphology and surgical access
- Merging IOS and CBCT data for comprehensive analysis in care planning
- Using visual data for patient consent and education

Monitoring and Maintenance

Repeat standardised periapical or bitewing radiographs only when clinically indicated to monitor bone changes. For example, if an engaged patient with good plaque control shows deterioration at certain sites, radiographs may help identify anatomical challenges or further bone loss. Repeat imaging can also guide adjustments in patient management, such as in cases with possible endodontic–periodontic involvement.

Sequential photographs and digital scans can be compared to assess soft tissue stability. Radiographic and imaging findings can further support decisions on individualised maintenance intervals and recall scheduling.

Communication and Documentation

Images serve as a universal language between clinicians. High-quality documentation supports referrals, legal protection and continuity of care.

Best Practice for Dental Hygienists and Dental Therapists

- Justify every exposure – ensure diagnostic benefit outweighs risk
- Standardise techniques – consistent geometry enables comparison
- Correlate imaging with clinical findings – never interpret in isolation
- Optimise safety – use rectangular collimation, digital sensors, and protective measures.
- Educate patients visually – photographs and scans foster understanding and compliance
- Commit to lifelong learning – AI-driven analysis and digital integration are rapidly advancing so keep up with emerging information

The Future: AI and Integrated Imaging

Artificial intelligence is reshaping image interpretation. Deep learning algorithms can now quantify alveolar bone

loss, detect furcations, and even stage periodontitis from radiographs with near-human accuracy. At the same time, merging intraoral scans, CBCT data, and clinical photographs into unified digital records offers a complete 3D picture of the periodontium. Future platforms will likely integrate these datasets into chairside diagnostic tools—enabling real-time visualisation and predictive analytics.

Conclusion

For dental hygienists and therapists, mastering clinical imaging is not optional—it is integral to comprehensive periodontal care. Imaging aids diagnosis, refines care planning, and documents healing in ways that elevate both clinical outcomes and patient engagement. From the fine detail of periapical radiographs to the precision of intraoral scans and the depth of CBCT, today's imaging toolkit empowers clinicians to see periodontal disease more clearly than ever before. Used judiciously, imaging bridges the gap between evidence and experience; helping patients appreciate, and preserve, the foundations of their oral health.

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