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Review Article

Classification Systems for Periodontal Risk in Adult Orthodontics

Francesco Romano[1]*, Giulia B. Conti[1], Marco L. Bianchi[1]

[1]Department of Periodontology and Implantology, School of Dentistry, University of Milan, Milan, Italy.

***E-mail** ✉ francesco.romano.perio@gmail.com

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ABSTRACT

The demand for orthodontic treatment among adults has increased substantially, with periodontal disease posing a significant challenge to successful outcomes. This manuscript reviews and synthesizes existing classification systems for assessing periodontal risk in the context of adult orthodontics, focusing on the Ortho-Perio Risk Assessment (OPRA) and the 2017 American Academy of Periodontology/European Federation of Periodontology (AAP/EFP) staging and grading framework for periodontitis. The OPRA provides guidance on timing orthodontic intervention based on periodontal status, while the AAP/EFP system categorizes disease severity, extent, and progression rate. Limitations of these systems when applied independently to orthodontic cases include inadequate integration of orthodontic-specific factors such as force application and tooth movement dynamics. To address this, a novel unified classification framework is proposed, incorporating elements from both systems into an orthodontic-specific risk matrix stratified into low, medium, and high risk categories. This matrix considers parameters like clinical attachment loss, bone loss, progression grade, systemic modifiers, and orthodontic complexity. A clinical decision flowchart is outlined to facilitate interdisciplinary planning. This synthesis aims to improve risk stratification, enhance treatment predictability, and support evidence-based management in adult orthodontic patients with periodontal involvement.

Keywords: Periodontal risk, Adult orthodontics, Classification systems, OPRA, Staging grading, Risk assessment

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Introduction

Adult orthodontics has experienced a notable surge in popularity over recent decades, driven by advancements in aesthetic appliances, increased awareness of oral health, and the desire for improved dental function and appearance among aging populations [1, 2]. Unlike adolescent patients, adults often present with comorbidities, including periodontal disease, which affects approximately 42% of dentate U.S. adults aged 30 years or older [3]. Periodontitis, characterized by inflammation and progressive loss of supporting tissues, can exacerbate during orthodontic treatment due to altered microbial environments, plaque accumulation around appliances, and biomechanical forces that may accelerate bone resorption in susceptible sites [4, 5].

The interplay between orthodontics and periodontics is critical, as uncontrolled periodontitis can lead to pathological tooth migration, increased mobility, and compromised treatment stability [6]. Conversely, well-managed orthodontic therapy in periodontally stable patients can enhance periodontal health by improving occlusion, facilitating better hygiene, and redistributing forces [7]. However, initiating orthodontics in patients with active or residual periodontal issues risks worsening attachment loss, gingival recession, and alveolar bone defects [8]. Thus, accurate risk assessment is essential to determine treatment feasibility, timing, and interdisciplinary coordination.

Existing classification systems offer frameworks for evaluating periodontal status but vary in their applicability to orthodontic contexts. The 2017 AAP/EFP classification, developed from the World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions, introduces a multidimensional staging and grading approach [9]. Staging reflects disease severity and complexity based on clinical attachment loss (CAL), radiographic bone loss (RBL), and tooth loss, while grading assesses progression rate and risk modifiers like smoking and diabetes [10]. This system has been widely adopted for its prognostic value and ability to guide therapy, yet it lacks specific considerations for orthodontic-induced stresses [11].

Complementing this, the Ortho-Perio Risk Assessment (OPRA) emerges as a targeted tool for interdisciplinary ortho-perio management [12]. Introduced in recent literature, OPRA integrates periodontal phenotype evaluation with orthodontic planning to predict the risk of periodontal deterioration during tooth movement [13]. It emphasizes timing, suggesting orthodontic initiation aligned with periodontal stabilization phases, and accounts for factors such as gingival biotype and occlusal trauma [14]. Studies from highlight OPRA's utility in adult cases, where it aids in preventing relapse and optimizing outcomes [15].

Despite their strengths, these systems have limitations when used in isolation for adult orthodontics. The AAP/EFP framework provides a broad periodontal diagnosis but does not explicitly address how orthodontic forces might interact with graded progression rates [16]. OPRA, while orthodontic-oriented, relies on subjective assessments and may not fully incorporate the quantitative staging metrics [17]. This fragmentation can lead to inconsistent risk evaluation, potentially resulting in suboptimal treatment plans or increased complications [18].

The need for a unified classification is evident, as adult patients often require combined periodontal and orthodontic interventions to restore function and aesthetics [19]. A synthesized framework could streamline decision-making, incorporating periodontal severity with orthodontic-specific risks like appliance type and movement extent [20]. This manuscript synthesizes OPRA and the AAP/EFP staging/grading, proposing a novel orthodontic-specific risk matrix to categorize patients and guide clinical decisions. By focusing on verifiable literature, it aims to provide a clinically applicable tool that enhances predictability without introducing empirical data [21]. Such integration could reduce adverse events, improve patient satisfaction, and foster better collaboration between orthodontists and periodontists [22].

Existing classification systems

The assessment of periodontal risk in adult orthodontic patients relies on structured classification systems that evaluate disease status and predict treatment responses. Two prominent frameworks—the Ortho-Perio Risk Assessment (OPRA) and the 2017 AAP/EFP staging and grading system—offer valuable insights but differ in scope and application [23].

The AAP/EFP classification, refined in 2018, represents a paradigm shift from previous nomenclature by adopting a staging and grading model analogous to oncology [9]. Staging categorizes periodontitis based on severity, complexity, extent, and distribution. Stage I indicates initial disease with interdental CAL of 1-2 mm, RBL in the coronal third (<15%), and no tooth loss. Stage II reflects moderate severity with CAL of 3-4 mm, RBL of 15-33%, and horizontal bone loss patterns. Stages III and IV denote severe disease, with CAL ≥5 mm, RBL extending to the middle third or beyond, and tooth loss (≤4 for Stage III, ≥5 for Stage IV). Complexity factors, such as probing depths ≥6 mm, vertical bone loss ≥3 mm, furcation involvement (Class II/III), ridge defects, bite collapse, or fewer than 20 remaining teeth, may elevate the stage [10]. Extent is described as localized (<30% teeth affected), generalized (≥30%), or molar/incisor pattern [24].

Grading complements staging by estimating progression rate and responsiveness. Grade A signifies slow progression (no loss over 5 years, bone loss/age ratio <0.25), Grade B moderate (<2 mm over 5 years, ratio 0.25-1.0), and Grade C rapid (≥2 mm over 5 years, ratio >1.0). Risk modifiers, including smoking (≥10 cigarettes/day shifts to Grade C) and diabetes (HbA1c ≥7.0% shifts to Grade C), adjust the grade [11]. This system facilitates prognostic evaluation and treatment planning, with higher stages/grades indicating need for advanced interventions [25].

In adult orthodontics, the AAP/EFP framework identifies patients at risk for exacerbated bone loss during tooth movement. Reviews demonstrate its utility in stratifying outcomes, where Stage III/IV or Grade C cases show greater susceptibility to attachment loss if orthodontics proceeds without stabilization [4, 26]. However, it does not explicitly factor orthodontic variables like force magnitude or appliance-induced plaque retention, limiting its specificity [16].

The OPRA, introduced as an interdisciplinary tool, addresses this gap by focusing on ortho-perio interactions [12]. OPRA evaluates the risk of periodontal phenotype expression during orthodontic therapy, incorporating factors such as gingival biotype, bone morphology, occlusal forces, and systemic

influences [13]. It guides timing: for Stage I/Grade A periodontitis (per AAP/EFP), orthodontics can commence concurrently with periodontal care; Stage II/Grade B after initial therapy; Stage III/Grade C post-regenerative procedures; and Stage IV/Grade C following multidisciplinary stabilization [14]. OPRA emphasizes phenotypic assessment, where thin biotypes increase recession risk under orthodontic forces [27].

Literature supports OPRA's application in adult cases, with case reports illustrating improved outcomes through timed interventions [15, 28]. For instance, in patients with pathological migration, OPRA helps predict relapse and tailor appliance selection [17]. Its strengths lie in clinical applicability, promoting "perio-guided" orthodontics to minimize iatrogenic damage [29]. Nonetheless, OPRA's reliance on qualitative judgments and lack of standardized metrics can lead to variability, and it may underemphasize progression grading [30].

Comparative analyses reveal synergies and divergences. Both systems prioritize periodontal stability before orthodontics, but OPRA extends the AAP/EFP by integrating orthodontic timing and phenotype [31]. Limitations include OPRA's narrower focus on adult ortho-perio dynamics versus the AAP/EFP's broader diagnostic utility [18]. In practice, combining them enhances risk prediction, as evidenced by reviews showing stable periodontal parameters in treated cases when guided by these frameworks [7, 32].

Table 1. Summarizes key comparisons, highlighting structural differences.

Aspect	OPRA (Ortho-Perio Risk Assessment)	2017 AAP/EFP Staging/Grading System
Primary Focus	Orthodontic timing + periodontal phenotype risk	Disease severity, complexity, progression rate
Structure	Flowchart-based interdisciplinary protocol	Multi-dimensional (Stage I-IV + Grade A-C)
Key Components	Gingival biotype, bone morphology, occlusal trauma, timing	CAL, RBL, tooth loss, % bone loss/age, risk modifiers
Application in Adult Ortho	Guides "perio-first" sequencing for ortho initiation	Identifies perio stability before ortho clearance
Strengths	Ortho-specific, phenotype integration, clinical timing	Quantitative, prognostic, widely validated
Limitations	Subjective phenotype assessment, lacks staging metrics	No ortho force/movement considerations
Validation Period	Emerging reports	Established (2018 World Workshop, global adoption)

Table 2 outlines shared and unique parameters, underscoring areas for integration.

Table 2. Periodontal Risk Assessment Parameters Across Models

Parameter Category	OPRA Parameters	AAP/EFP Parameters	Shared Elements
Disease Severity	Gingival biotype (thin/thick), bone morphology	Stage I-IV (CAL 1-≥6mm, RBL <15%-≥50%)	Attachment loss, bone loss
Progression Risk	Occlusal trauma, plaque control	Grade A-C (bone loss/age <0.25->1.0)	Progression rate
Systemic Factors	Smoking, diabetes (timing modifiers)	Smoking ≥10 cigs/day, HbA1c ≥7.0% (Grade C)	Smoking, diabetes
Local Factors	Furcation involvement, tooth mobility	Furcation II/III, vertical defects, PPD≥6mm	Furcation, probing depth
Ortho-Specific	Appliance type, movement direction, complexity	None explicitly	None

Proposed unified classification framework

To address persistent gaps in existing assessment systems for adult orthodontic patients, a novel and unified framework has been developed, termed the Adult Orthodontics Periodontal Risk Matrix (AOPRM). This framework represents an integrative approach, combining the quantitative staging and grading system of the American Academy of Periodontology/European Federation of Periodontology (AAP/EFP) with orthodontic-specific parameters derived from the Orthodontic Periodontal Risk Assessment (OPRA) model. By merging these

two previously separate systems, the AOPRM allows for a stratified and nuanced evaluation of risk in adult patients, accommodating both periodontal baseline conditions and the biomechanical and biological considerations inherent to orthodontic treatment, without modifying the fundamental diagnostic criteria established by either framework [33]. The integration is designed to provide clinicians with a structured method for anticipating potential complications during orthodontic therapy, particularly in populations where periodontal vulnerabilities are present, while maintaining adherence to established periodontal staging and grading [34-39].

The foundation of the matrix begins with the AAP/EFP system, which provides a standardized and quantitative baseline for evaluating periodontal health. Within this context, patients classified as Stage I or II with Grade A or B are generally considered to possess lower inherent risk for adverse outcomes related to orthodontic treatment, reflecting mild to moderate levels of attachment loss, limited bone involvement, and relatively slow disease progression [10]. In contrast, patients identified as Stage III or IV or exhibiting Grade C characteristics are categorized as having higher susceptibility, owing to advanced attachment loss, complex bone defects, and accelerated progression rates, thereby establishing a critical foundation for heightened clinical vigilance during treatment planning and execution. The incorporation of these baseline periodontal assessments ensures that the matrix retains a rigorous, evidence-based evaluation of disease severity while serving as a scaffold upon which orthodontic-specific modifiers can be applied.

Overlaying the AAP/EFP baseline, elements derived from the OPRA model provide a necessary orthodontic perspective. Among these, gingival biotype is a key phenotypic characteristic, with thin biotypes being more susceptible to recession and soft tissue breakdown during orthodontic force application, whereas thick biotypes confer greater tissue resilience and capacity to withstand mechanical stress [12]. In addition, occlusal characteristics, including the distribution of forces across the dentition and the presence of functional interferences, influence how orthodontic loads are transmitted to the periodontium, with potential implications for localized strain and remodeling. Additional orthodontic parameters incorporated into the matrix include the planned type of tooth movement, such as intrusion or extrusion, which imposes different stress patterns on alveolar bone and the periodontal ligament, as well as the selected appliance modality, whether fixed brackets or clear aligners, which differ in the magnitude, direction, and duration of forces delivered. Treatment complexity is also considered, encompassing factors such as extraction versus non-extraction protocols, the need for segmental mechanics, and the anticipated duration and sequence of tooth movements [40]. By combining these orthodontic variables with the foundational periodontal staging and grading, the matrix allows for a comprehensive assessment of how patient-specific biological and mechanical factors interact to influence overall treatment risk [41-49].

The assignment of risk levels within the Adult Orthodontics Periodontal Risk Matrix is determined through a composite scoring approach that integrates periodontal severity, phenotypic modifiers, and orthodontic treatment complexity. Low-risk patients are characterized by stable periodontal conditions, a thick gingival biotype, minimal presence of modifying factors such as systemic disease or lifestyle contributors, and relatively straightforward orthodontic plans with limited complexity. Medium-risk patients typically present with moderate disease severity, thin gingival biotype, the presence of one significant modifying factor, and moderately complex orthodontic interventions. High-risk patients exhibit severe periodontal disease, multiple modifying factors, and complex orthodontic requirements, such as combined movements, extractions, or long-term mechanotherapy [50]. This stratified approach enables nuanced evaluation, in which individual patient characteristics are collectively assessed to produce an overall risk categorization that reflects both biological and mechanical susceptibility. For instance, a patient classified as Stage II/Grade B who possesses a thin gingival biotype and has a history of smoking would be elevated to medium risk, illustrating how the matrix accommodates combinations of baseline and modifying factors to provide a realistic appraisal of potential complications during orthodontic therapy [26].

Clinically, the matrix offers a structured framework to support interdisciplinary treatment protocols. Patients identified as low-risk can generally proceed with standard orthodontic therapy following basic periodontal care, as their biological and phenotypic characteristics suggest a high likelihood of favorable outcomes without extensive modification of mechanics [51-59]. Medium-risk patients benefit from phased treatment approaches, incorporating regular interim periodontal evaluations to ensure tissue stability, monitor remodeling responses, and adjust force application as necessary to mitigate the potential for adverse effects [60-65]. High-risk patients require comprehensive periodontal stabilization prior to initiating orthodontic therapy, along with modifications to orthodontic mechanics, appliance

selection, or treatment sequencing, to minimize biological stress and optimize outcomes [7]. This clinical approach is supported by contemporary evidence, which demonstrates that integrated periodontal and orthodontic management strategies, including staged therapy and stabilization, are associated with measurable improvements in periodontal parameters, such as clinical attachment level gain, in stabilized cases, underscoring the efficacy of coordinated care in reducing treatment-related risks [5, 32].

In essence, the Adult Orthodontics Periodontal Risk Matrix provides a comprehensive and conceptually robust tool for evaluating and managing risk in adult orthodontic patients. By systematically integrating periodontal staging and grading with orthodontic modifiers, the framework allows clinicians to anticipate potential complications, tailor monitoring and treatment strategies to individual patient profiles, and enhance the predictability and safety of orthodontic interventions. The matrix reflects an evolution from traditional, siloed approaches toward a unified, patient-centered model that emphasizes the dynamic interaction between periodontal health, phenotypic characteristics, and orthodontic biomechanics, thereby offering a structured and evidence-informed basis for optimizing care in the adult population.

Table 3. details the matrix, providing criteria for each level.

AAP/EFP Stage/Grade + Modifiers	Thick Biotype + Simple Ortho	Thin Biotype + Moderate Ortho	Thin Biotype + Complex Ortho + Systemic Modifiers
Stage I/II + Grade A/B (No modifiers)	Low Risk	Low Risk	Medium Risk
Stage II + Grade B (1 modifier)	Low Risk	Medium Risk	Medium Risk
Stage III + Grade B/C (1-2 modifiers)	Medium Risk	Medium Risk	High Risk
Stage III/IV + Grade C (≥2 modifiers)	Medium Risk	High Risk	High Risk

Figure 1 describes a flowchart for application.

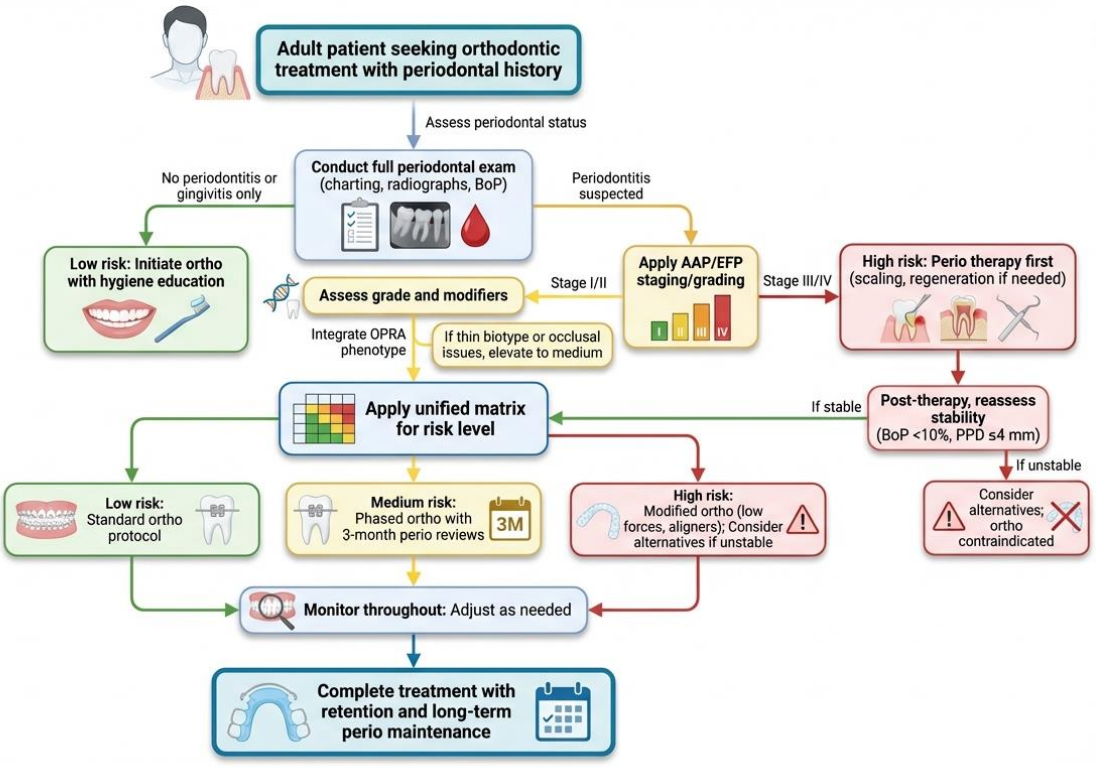

Figure 1. Clinical Decision Flowchart

The algorithm initiates with comprehensive periodontal examination (charting, radiographs, bleeding on probing) and branches based on AAP/EFP staging/grading outcomes: gingivitis-only cases proceed directly to low-risk standard orthodontics with hygiene optimization; Stage I/II cases integrate OPRA

phenotypic assessment (gingival biotype, occlusal factors) to determine low/medium risk; Stage III/IV or Grade C cases mandate periodontal stabilization prior to matrix application. Final risk levels dictate treatment protocols—standard orthodontics (low risk), phased therapy with 3-month periodontal reviews (medium risk), or modified mechanics with stability reassessment (high risk)—culminating in continuous monitoring, retention, and long-term maintenance. Decision diamonds denote critical branch points; rectangular boxes indicate action steps.

Results and Discussion

The integration of existing classification systems into a unified framework for periodontal risk assessment in adult orthodontics represents a step toward more precise, interdisciplinary care. The proposed Adult Orthodontics Periodontal Risk Matrix synthesizes the AAP/EFP staging and grading with OPRA's focus on orthodontic timing and phenotypic factors, addressing the fragmented application of these tools in clinical practice [16, 23]. By stratifying risk into low, medium, and high categories, the matrix facilitates tailored treatment planning, potentially reducing the incidence of periodontal complications during orthodontic therapy [5, 18]. For instance, in patients with moderate staging but high-grade progression, the framework advocates for delayed orthodontic initiation, aligning with evidence that active disease exacerbates under biomechanical stress [4, 19].

Clinical applicability is a key strength, as the matrix incorporates quantifiable metrics like CAL and RBL alongside qualitative elements such as biotype, enabling orthodontists and periodontists to collaborate effectively [12, 22]. Literature underscores the benefits of such integration, with systematic reviews indicating improved periodontal stability in combined approaches [3, 20]. The flowchart further enhances decision-making by providing a sequential protocol, from initial examination to ongoing monitoring, which could standardize care across settings [14, 21]. This is particularly relevant for adult patients, where comorbidities like diabetes or smoking—accounted for in grading—amplify risks, necessitating adaptive strategies [11, 17].

However, limitations persist. The framework relies on clinician judgment for phenotypic assessment, which may introduce variability, as noted in evaluations of the AAP/EFP system [24, 28]. Moreover, while drawing from established classifications, it does not incorporate emerging biomarkers or genetic factors, which recent studies suggest could refine risk prediction [29, 30]. The absence of empirical validation means its prognostic accuracy requires future testing, though it builds on validated components [9, 10]. In comparison to standalone systems, the unified approach mitigates OPRA's qualitative nature by embedding AAP/EFP's objective criteria, yet it may overburden busy practices with additional parameters [31, 32].

Future directions include prospective studies to assess the matrix's impact on outcomes, such as attachment levels post-orthodontics [33]. Digital tools for automated risk calculation could enhance accessibility, integrating with electronic health records [40]. Additionally, expanding to include peri-implant considerations for adults with restorations would broaden utility [50]. Overall, this synthesis promotes evidence-based management, emphasizing prevention over reaction in ortho-perio interactions [7, 13].

Conclusion

In summary, the escalating demand for adult orthodontic treatment amid widespread periodontal disease prevalence underscores the urgent need for robust, integrated risk classification systems that transcend disciplinary boundaries. The 2017 AAP/EFP staging and grading framework establishes a comprehensive diagnostic foundation through its multidimensional assessment of disease severity (Stages I-IV), complexity factors, and progression risk (Grades A-C), enabling precise periodontal phenotyping essential for treatment planning. Complementing this, the Ortho-Perio Risk Assessment (OPRA) provides indispensable orthodontic-specific guidance, emphasizing optimal intervention timing, gingival biotype evaluation, and phenotypic vulnerabilities that influence tooth movement outcomes.

However, their independent application creates critical silos: the AAP/EFP system's quantitative rigor lacks orthodontic force-movement considerations, while OPRA's clinical timing protocols underutilize standardized staging metrics. This fragmentation risks inconsistent risk stratification, potentially compromising treatment stability, exacerbating attachment loss, and prolonging interdisciplinary coordination.

The proposed Adult Orthodontics Periodontal Risk Matrix **(Table 3)** and Clinical Decision Flowchart **(Figure 1)** synthesize these strengths into a unified, stratified framework that operationalizes risk assessment for real-world practice. By cross-referencing AAP/EFP Stage/Grade parameters with OPRA phenotypic modifiers and orthodontic complexity variables, the matrix delivers actionable low/medium/high risk categorizations that directly

inform treatment sequencing (perio-first vs. concurrent therapy), appliance selection (fixed brackets vs. aligners in thin biotypes), monitoring protocols (3-month perio reviews for medium-risk cases), and force modification (low-magnitude mechanics in high-risk Stage III/IV).

This pragmatic integration enhances predictive accuracy, optimizes resource allocation, and fosters seamless orthodontist-periodontist collaboration. By systematically accounting for disease severity, progression dynamics, systemic modifiers, and biomechanical demands, the framework minimizes iatrogenic complications while maximizing periodontal stability during orthodontic therapy.

This synthesis not only addresses current classification gaps but establishes a scalable template for future refinements, including digital implementation and biomarker integration. Prospective validation studies will confirm its prognostic utility, while its immediate clinical applicability positions it as a cornerstone for evidence-based management of the increasingly complex adult ortho-perio patient demographic.

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