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Original Article

Interdisciplinary Orthodontic–Periodontal Management in Adult Patients: Timing, Sequencing, and Risk Control

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ABSTRACT

The increasing prevalence of periodontal disease among adults seeking orthodontic treatment necessitates a robust interdisciplinary approach to optimize outcomes while minimizing risks. This narrative review synthesizes recent evidence on the management of adult patients with periodontal compromise undergoing orthodontic therapy, with a focus on timing, sequencing, and risk control. Drawing from peer-reviewed studies published between 2020 and 2025, the review highlights the importance of achieving periodontal stability prior to orthodontic intervention, typically through non-surgical and surgical therapies, followed by carefully timed tooth movement. Sequencing strategies emphasize phased integration of periodontal regeneration and orthodontic mechanics, such as early or delayed initiation post-surgery to leverage biological healing processes. Risk mitigation involves light forces, enhanced hygiene protocols, and ongoing monitoring to prevent exacerbation of bone loss, recession, or inflammation. The objectives are to provide clinicians with evidence-based guidelines for interdisciplinary collaboration, ensuring functional, aesthetic, and long-term periodontal health. Key findings underscore that, when inflammation is controlled, orthodontic treatment can enhance periodontal parameters without significant adverse effects, but requires individualized planning based on disease severity and patient compliance.

Keywords: Orthodontics, Periodontitis, Interdisciplinary management, Timing, Sequencing, Risk control

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Introduction

In contemporary dental practice, adult orthodontics has emerged as a rapidly growing field, driven by increased aesthetic awareness, functional rehabilitation needs, and broader access to advanced therapeutic modalities [1,2]. Unlike adolescents, adult patients often present with systemic and local comorbidities, among which periodontal disease is particularly prevalent. Globally, up to 50% of adults exhibit periodontitis, with prevalence rising sharply with age, and the severity of alveolar bone loss correlating with functional impairment and risk of tooth loss [3]. Periodontitis, characterized by chronic inflammation, progressive destruction of the alveolar bone, and loss of periodontal attachment, not only compromises the structural integrity of the dentition but also induces secondary malocclusions. Tooth migration, flaring, extrusion, spacing, and midline deviations frequently result from uneven bone support, creating functional and esthetic challenges that complicate orthodontic planning [4,5]. These malocclusions can further exacerbate plaque retention, fostering a self-perpetuating cycle of periodontal deterioration if not properly managed [6].

The relationship between orthodontic interventions and periodontal health is inherently bidirectional. Application of orthodontic forces triggers a sterile

inflammatory response within the periodontal ligament (PDL) and surrounding alveolar bone, which is necessary for controlled tooth movement. However, in patients with pre-existing periodontal compromise, this inflammation may exacerbate bone loss or gingival recession if not carefully modulated [7]. Conversely, periodontal therapy—ranging from non-surgical scaling and root planing to regenerative procedures—restores tissue health, reduces inflammatory burden, and establishes a stable environment for safe and predictable tooth movement. Contemporary evidence indicates that, with rigorous inflammation control, judicious force application, and careful monitoring, orthodontic treatment does not inherently worsen periodontal outcomes and can, in some cases, enhance functional alignment and hygiene accessibility [8,9].

Adult patients with advanced periodontitis (stages III and IV) present additional complexities. Reduced alveolar bone height and density alter centers of resistance, increasing biomechanical challenges in force application and elevating the risk of adverse sequelae such as root resorption, gingival recession, and post-treatment relapse [10,11]. Furthermore, these patients often require individualized treatment sequencing, integrating periodontal regeneration, orthodontic mechanics, and occlusal rehabilitation to maximize both esthetic and functional outcomes.

Given these considerations, interdisciplinary management has become paramount. Optimal timing—determining the appropriate interval between periodontal stabilization and the initiation of orthodontic forces—ensures that tissues can tolerate mechanical stress without compromising regeneration. Sequencing—the strategic ordering of periodontal and orthodontic interventions—aligns biologic healing with mechanical demands, while risk control strategies, including force calibration, appliance selection, meticulous hygiene protocols, and regular monitoring, mitigate potential complications as showed in **figure 1**.

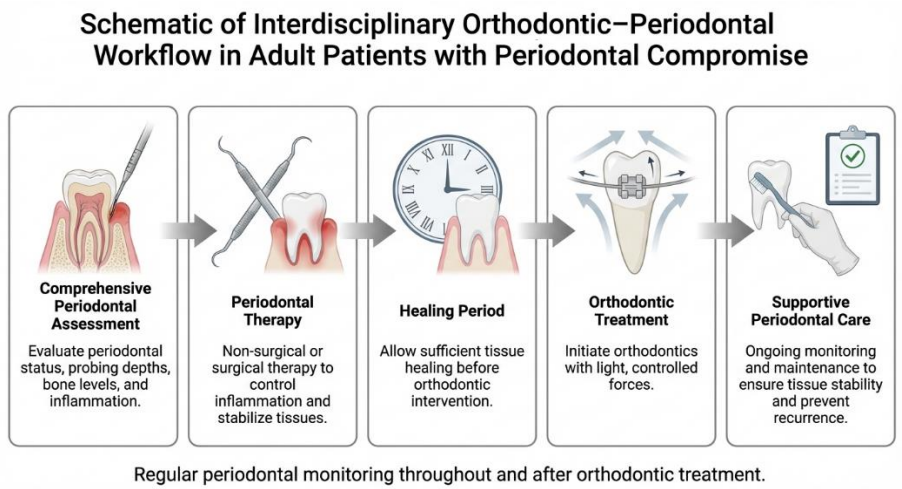

Figure 1. Interdisciplinary sequencing of periodontal and orthodontic treatment in adult patients

The objectives of this review are threefold: (1) to delineate evidence-based protocols for pre-orthodontic periodontal preparation, including non-surgical and regenerative approaches; (2) to examine sequencing paradigms that integrate periodontal healing with orthodontic mechanics, ensuring predictable tooth movement; and (3) to outline risk assessment and preventive measures, emphasizing biomechanical principles, phenotype considerations, and adjunctive therapies to enhance long-term stability. By synthesizing high-quality studies—including systematic reviews, randomized controlled trials, and expert consensus documents published from 2020 to 2025—this article aims to provide clinicians with a comprehensive, up-to-date framework for managing adult patients with compromised periodontal support undergoing orthodontic treatment, ultimately promoting functional rehabilitation, esthetic optimization, and periodontal preservation.

Periodontal Assessment and Diagnosis in Adult Orthodontic Candidates

Comprehensive periodontal evaluation is the cornerstone of interdisciplinary management in adult orthodontic patients, as undetected or inadequately managed periodontal disease can compromise both the efficacy and safety of tooth movement [1,12]. A thorough assessment begins with a detailed medical and dental history, emphasizing systemic conditions that influence periodontal health, including diabetes mellitus, smoking, cardiovascular disease, osteoporosis, and immunosuppressive states. These

factors not only exacerbate chronic periodontitis but also impair tissue healing, bone turnover, and the patient's capacity to tolerate orthodontic forces [13]. Medications such as bisphosphonates, corticosteroids, or biologics may also alter bone remodeling and must be factored into treatment planning.

Clinical Examination

The clinical evaluation encompasses multiple parameters to assess current periodontal status and predict risk during orthodontic therapy. Key measures include:

- **Probing pocket depths (PPD)** and **clinical attachment levels (CAL):** Quantify the depth of the sulcus/pocket and the degree of attachment loss, respectively, which are critical for staging periodontitis and identifying sites at risk of further breakdown during tooth movement [4,8].
- **Bleeding on probing (BOP)** and **plaque indices:** Indicators of current inflammatory activity and oral hygiene status; thresholds such as full-mouth BOP <10–15% and plaque scores <15–20% are recommended to ensure a quiescent periodontium prior to orthodontic loading [1,13].
- **Gingival recession and keratinized tissue width (KTW):** Assess susceptibility to soft tissue breakdown during labial or lingual movements, especially in thin phenotypes (<2 mm) which often require pre-orthodontic soft tissue grafting or augmentation [2,11].
- **Tooth mobility and fremitus:** Detect secondary occlusal trauma and evaluate the functional stability of teeth, which may influence force application strategies.
- **Mucogingival assessment:** Evaluates the presence of adequate attached gingiva and mucosal thickness, guiding decisions on phenotype modification and periodontal augmentation prior to tooth movement.

Radiographic Analysis

Radiographic imaging complements the clinical assessment, providing a three-dimensional understanding of alveolar bone architecture, root morphology, and defect patterns. Conventional periapical and panoramic films allow initial detection of bone loss, while **cone-beam computed tomography (CBCT)** offers high-resolution visualization of infrabony defects, furcation involvement, cortical plate thickness, and proximity to anatomical structures [3,6]. Radiographic evaluation facilitates accurate staging of periodontitis according to the 2017 World Workshop classification: Stage III/IV disease is characterized by CAL ≥4 mm, PPD ≥6 mm, and radiographic bone loss extending to the middle or apical third of the root, often associated with vertical defects and furcation involvement [5,10].

Phenotype and Occlusal Considerations

Periodontal phenotype assessment is increasingly recognized as a predictor of treatment outcomes. Thin gingival biotypes are more prone to recession during labial or proclination movements, whereas thick phenotypes confer protective advantages. Identification of high-risk phenotypes guides pre-orthodontic interventions, including connective tissue grafting, free gingival grafts, or subepithelial grafting, to reinforce soft tissue and mitigate future complications [2,11]. Secondary occlusal trauma from malpositioned teeth may aggravate periodontal compromise, necessitating coordinated orthodontic and periodontal planning, such as selective intrusion or realignment to redistribute occlusal forces [7,9].

Adjunctive Diagnostic Tools

Emerging diagnostic modalities provide additional granularity in risk assessment:

- **Microbial profiling:** Identification of pathogenic bacteria, such as *Porphyromonas gingivalis* or *Tannerella forsythia*, can stratify risk for rapid progression during orthodontic treatment.
- **Biomarkers in gingival crevicular fluid (GCF):** Elevated levels of IL-1β, TNF-α, and matrix metalloproteinases (MMPs) may indicate active inflammation or heightened resorptive potential, informing timing of orthodontic intervention [4].

Prognostication and Treatment Planning

A holistic diagnosis enables prognostication of individual teeth as:

- **Safe:** Minimal attachment loss, stable mobility, favorable crown-to-root ratios, suitable for direct orthodontic loading.
- **Questionable:** Moderate bone loss or mobility requiring force modification, staged movement, or temporary anchorage support.
- **Hopeless:** Severe bone loss, advanced furcation involvement, or mobility necessitating extraction and potential implant planning [6,12].

This structured approach not only informs risk mitigation strategies but also guides personalized treatment objectives, such as prioritizing intrusion of extruded incisors to restore periodontal support, or staging tooth movement to allow optimal bone adaptation [8]. By integrating systemic, clinical, radiographic, and molecular data, clinicians can

establish a stable and inflammation-free foundation for safe, efficient, and predictable adult orthodontic therapy.

Biomechanical Considerations in the Compromised Periodontium

In adult patients with periodontally compromised dentition, reduced alveolar bone support significantly alters tooth biomechanics, necessitating careful recalibration of orthodontic forces. The center of resistance (CRes) of a tooth, which defines the point at which force application produces pure translation, shifts apically in proportion to the extent of bone loss. In a healthy periodontium, CRes is typically located approximately one-third of the root length from the alveolar crest; however, with 50% bone loss, it migrates to the middle third, increasing susceptibility to uncontrolled tipping, extrusion, and stress concentration at the alveolar crest [5,7,9,10]. Consequently, forces must be reduced—typically to 5–15 grams per tooth for anterior teeth—and moment-to-force ratios adjusted to achieve bodily movement while minimizing deleterious stress on the periodontium.

Appliance Selection and Mechanics

Orthodontic appliances must be chosen and calibrated with periodontal health in mind. Fixed multibracket systems offer precise control of force vectors, torque, and moments, but their plaque-retentive surfaces may increase colonization by pathogens such as *Porphyromonas gingivalis*, exacerbating inflammation [2,11]. Clear aligners provide superior hygiene maintenance and are advantageous in mild-to-moderate periodontitis, though they may be less effective in cases of severe mobility, furcation involvement, or complex three-dimensional tooth movements [1,13].

Advanced biomechanical strategies—such as segmented arch mechanics, power arms, and temporary anchorage devices (TADs)—allow controlled intrusion or distalization without reciprocal extrusion, which is critical when addressing flared or proclined incisors at risk of dehiscence [4,6]. Intermittent force application has been shown to permit partial cementum repair and reduce root resorption relative to continuous loading, highlighting the importance of force modulation in compromised teeth [3,8].

For posterior teeth with furcation involvement (stage IV periodontitis), stability and periodontal integrity must be carefully evaluated. While molars may occasionally serve as anchorage if adequately stabilized, TADs or mini-implants are often preferred to avoid overloading compromised roots and alveolar bone [12]. Bonding brackets more cervically on the crown can increase the distance to the apically shifted CRes, reducing moment arms and minimizing tipping forces [5]. Overall, biomechanics in the compromised periodontium must balance efficiency of tooth movement with periodontal safety, tailoring strategies to bone loss extent, defect morphology, and tissue phenotype [7].

Timing of Orthodontic Intervention Following Periodontal Therapy

Optimal timing of orthodontic force application is critical to allow periodontal healing while taking advantage of regenerative potential and the regional acceleratory phenomenon (RAP) to enhance bone remodeling. Following non-surgical periodontal therapy, including scaling and root planing, a typical reassessment period of 3–6 months is recommended, ensuring clinical endpoints such as PPD ≤4–5 mm and full-mouth BOP <15% before initiating orthodontic forces [1,2,5].

For surgical interventions, timing must consider tissue maturation and graft integration. Post-resective or open-flap debridement, orthodontic treatment is often delayed 6–9 months, whereas regenerative procedures (e.g., guided tissue regeneration, bone grafting) generally require 6–12 months to allow for stabilization of alveolar bone and soft tissues [6,9]. However, emerging evidence challenges prolonged waiting periods. A multicenter study demonstrated superior clinical attachment gains when orthodontic forces were applied 4 months after regenerative surgery compared to delayed protocols, suggesting that controlled early movement may synergize with tissue healing [3]. Similarly, a randomized trial comparing early initiation (10 days) versus delayed (3 months) post-flap debridement found no significant differences in periodontal outcomes, with early-treated patients benefiting from shorter overall treatment times due to RAP-mediated accelerated bone turnover [8].

Despite these promising findings, early orthodontic intervention carries inherent risks, particularly in patients with extensive defects, incomplete tissue maturation, or suboptimal compliance. Patient-specific considerations—such as defect morphology, graft type, oral hygiene adherence, and systemic health—must guide individualized timing decisions [10,13]. Consensus guidelines currently recommend a 3–4 month waiting period following non-surgical therapy for moderate periodontitis and extend to approximately 6 months following regenerative procedures in deep infrabony defects [1,11]. Strategic integration, such as

simultaneous TAD placement during surgical procedures, can streamline treatment without compromising periodontal stability [7,12].

In summary, successful orthodontic management in the periodontally compromised adult patient hinges on precise biomechanical planning and judicious timing of force application. Tailoring force magnitude, direction, appliance selection, and sequencing to the altered center of resistance and tissue status ensures efficient tooth movement while preserving periodontal health, maximizing long-term stability, and minimizing adverse sequelae. Continuous clinical and radiographic monitoring is essential to adapt treatment plans dynamically to the evolving tissue response.

Sequencing of Interdisciplinary Treatments

The integration of periodontal and orthodontic phases in adult patients with compromised periodontium is essential to optimize both tissue regeneration and functional tooth alignment [4,6]. Sequencing ensures that periodontal health is established and maintained before applying orthodontic forces, thereby reducing the risk of exacerbating inflammation or attachment loss. The European Federation of Periodontology (EFP) stepwise protocol provides a widely accepted framework for this process. The protocol begins with thorough hygiene instruction and risk factor management, including smoking cessation, glycemic control, and nutritional counseling. This foundational phase is followed by subgingival instrumentation to reduce microbial load and active inflammation. Residual pockets or defects are then addressed surgically, either through access flaps, osseous resection, or regenerative procedures. Throughout all stages, supportive periodontal care (SPC) is maintained to monitor tissue response and prevent recurrence of inflammation [1,9].

For adults presenting with secondary malocclusions resulting from periodontal deterioration, sequencing typically begins with non-surgical therapy to halt inflammatory progression and stabilize the periodontium [2,5]. After an appropriate healing interval, usually three to six months, a re-evaluation is performed to ensure that endpoints such as probing depths ≤4–5 mm, minimal bleeding on probing, and stable plaque control are achieved. If these targets are not met, non-regenerative surgical procedures precede regenerative therapy in intrabony defects, with orthodontic treatment initiated only after adequate healing has occurred [3,10].

Two strategic sequencing paradigms are commonly employed. The surgery-first approach involves correcting periodontal defects prior to orthodontic intervention, preventing tooth movements from compromising surgical outcomes and ensuring optimal regenerative potential. In contrast, the orthodontics-first approach repositions teeth before surgical intervention, enhancing defect morphology, improving access for regeneration, and facilitating better alignment in the subsequent phases. For example, uprighting tilted molars or performing controlled extrusion can optimize ridge architecture, while pre-surgical intrusion may reduce excessive crown exposure, facilitating flap adaptation and graft stability [7,11].

Specific orthodontic movements are sequenced according to their biological impact on bone and soft tissues. Extrusion prior to surgery promotes coronal bone gain, enhancing the vertical dimension and supporting regenerative procedures. Intrusion following wide defect surgery facilitates clinical attachment level (CAL) improvement by encouraging bone deposition in the defect site. Tipping or uprighting pre-surgery stimulates localized bone remodeling, improving surgical access and optimizing the mechanical environment for regenerative success [8,13]. Prosthetic interventions, such as the placement of implants to restore posterior support or provide anchorage, may precede orthodontic treatment when occlusal stability is compromised, ensuring that applied forces do not overload compromised teeth or alveolar bone [12]. Completion of treatment involves occlusal adjustment, definitive restorations, and implementation of retention strategies, all integrated with ongoing supportive periodontal care to maintain long-term stability [6]. This pyramid-like sequencing—first establishing periodontal health, then addressing anchorage and biomechanics, performing targeted tooth movements, and finally instituting retention—has demonstrated synergy, with systematic reviews reporting probing pocket depth reductions of three to four millimeters and CAL gains of up to five millimeters in integrated care models [4].

Risk Factors and Mitigation Strategies

Adult interdisciplinary orthodontic-periodontal treatment carries inherent risks, including inflammation recurrence, progressive attachment loss, gingival recession, orthodontically induced root resorption, and post-treatment relapse [1,5]. These risks are amplified in older patients due to age-related reductions in bone turnover, cellular activity, and regenerative capacity, as well as systemic comorbidities such as diabetes, cardiovascular disease, and smoking-induced vascular compromise [14-22].

Microbial risks are heightened by plaque accumulation around orthodontic appliances, particularly fixed multibracket systems, which can harbor pathogenic biofilms. Mitigation strategies emphasize enhanced oral hygiene, including the use of interproximal brushes, antiseptic rinses such as chlorhexidine, and professional cleaning at regular SPC intervals, typically every three months [2,9].

Biomechanical risks must also be carefully managed [23-32]. Excessive proclination or labial movement of teeth in thin gingival biotypes can precipitate alveolar dehiscence and recession. Pre-orthodontic soft tissue grafting or phenotype modification can mitigate these risks, creating a more resilient periodontium capable of withstanding orthodontic forces [3,10]. Mobility resulting from reduced alveolar support can be managed by staging bracket placement, employing passive holding phases during periods of exacerbated inflammation, and utilizing temporary anchorage devices (TADs) or segmented arch mechanics to minimize uncontrolled tipping or extrusion [6,11].

Systemic factors must be optimized prior to treatment initiation. Smoking cessation is strongly recommended, and metabolic or inflammatory disorders such as poorly controlled diabetes should be addressed to enhance tissue healing and reduce the likelihood of adverse periodontal or orthodontic outcomes [7].

Ongoing monitoring is critical for risk mitigation. Clinical parameters—including probing depth, bleeding on probing, gingival recession, and tooth mobility—should be assessed quarterly, with radiographs obtained annually or as indicated [4,13]. Orthodontic forces should be paused if inflammation or bleeding increases, with treatment resumed only after periodontal stability is re-established. Retention strategies, combining fixed lingual wires with removable vacuum-formed splints, are employed to prevent post-treatment tooth migration, while lifelong SPC is tailored to individual risk profiles, reinforcing oral hygiene and monitoring for recurrent disease [8,12]. Evidence from systematic reviews indicates that, when risk factors are effectively controlled, interdisciplinary orthodontic-periodontal treatment does not result in net periodontal deterioration and may provide additional benefits, including improved oral hygiene, enhanced attachment stability, and more predictable long-term outcomes [5].

Clinical Applications in Specific Scenarios

Management of adult patients with compromised periodontium requires individualized sequencing strategies that integrate periodontal therapy with orthodontic mechanics to optimize both regeneration and tooth alignment. In cases of anterior flaring accompanied by extrusion, the initial phase involves non-surgical periodontal therapy to arrest inflammation, reduce bacterial load, and stabilize soft tissue [1,6]. Following a healing interval, typically around three months, controlled intrusion can be performed using segmented arch mechanics supported by temporary anchorage devices (TADs). This approach allows precise force application to intrude extruded incisors while minimizing unwanted tipping or reciprocal extrusion of adjacent teeth. Continuous monitoring of the gingival margin and keratinized tissue is essential during this phase to detect early signs of recession, ensuring that force magnitude and vector do not compromise periodontal integrity [33-41].

For posterior defects, strategic uprighting of molars prior to regenerative surgery has been shown to improve defect morphology, facilitating better access and stabilization of bone grafts or biologic agents [3,9]. Uprighting forces applied pre-regeneration optimize the angulation of teeth relative to alveolar bone, promoting improved fill and attachment gain. Following surgical intervention, orthodontic movements are timed carefully, often around six months post-surgery, to allow adequate healing of regenerated tissues while leveraging the regional acceleratory phenomenon (RAP) to enhance bone remodeling and tooth movement efficiency [42-52].

In stage IV periodontitis, where posterior molars may be missing or severely compromised, prosthetic planning is integrated with orthodontic therapy to provide stable anchorage. Implant placement prior to orthodontic tooth movement offers rigid support, mitigating the risk of overload on remaining teeth and enabling controlled force distribution during complex movements [2,10]. This approach is particularly valuable when significant anterior or posterior movements are required, as it preserves the integrity of the compromised periodontium and facilitates predictable orthodontic outcomes.

Appliance selection is dictated by the degree of periodontal compromise and patient-specific hygiene considerations. Clear aligners are advantageous in mild to moderate cases due to their removable nature, which facilitates oral hygiene and reduces plaque accumulation around teeth with limited bone support [4,11]. However, in situations involving severe tooth mobility, complex tipping, or extensive space closure, fixed appliances remain the preferred choice, providing superior control over tooth movement vectors, torque expression, and force distribution.

Collectively, these clinical scenarios emphasize the necessity of an individualized, evidence-driven approach that balances biological healing with mechanical efficiency. The integration of periodontal stabilization, precise biomechanical planning, and appropriate appliance selection ensures both functional and esthetic outcomes, while minimizing risks such as gingival recession, attachment loss, or relapse [7,13]. By tailoring treatment sequencing and mechanics to specific anatomic and pathological conditions, clinicians can achieve predictable, stable, and long-term results in adult patients with compromised periodontal support.

Discussion

The interdisciplinary management of adult orthodontic patients with periodontal involvement represents a paradigm shift from isolated specialty care to integrated, patient-centered strategies that prioritize long-term tissue health and functional stability [1,2]. As delineated in the main text, the foundational elements—periodontal assessment, biomechanical adaptations, timing, sequencing, and risk mitigation—collectively underscore the necessity for collaborative protocols to navigate the complexities of reduced bone support and inflammatory susceptibility [3,4]. Recent expert consensuses and clinical trials reinforce that, when executed meticulously, orthodontic intervention not only rectifies malocclusions but can augment periodontal parameters, such as reducing pocket depths and enhancing attachment levels, particularly in stage III/IV periodontitis [5,6].

A pivotal discussion point is the timing of orthodontic initiation post-periodontal therapy, where evidence from randomized trials suggests that early intervention (e.g., 10-14 days after surgery) may harness the regional acceleratory phenomenon to expedite remodeling without compromising outcomes, contrasting with traditional delays of 3-6 months [7,8]. This aligns with biomechanical principles, where light, controlled forces in a stabilized periodontium minimize iatrogenic damage, as supported by systematic reviews indicating no significant increase in recession or bone loss when inflammation is absent [9,10]. However, discrepancies arise in severe cases, where delayed approaches mitigate risks of incomplete healing, highlighting the need for case-specific decision-making informed by defect morphology and patient factors [11,12].

Sequencing paradigms further illuminate the symbiotic ortho-perio relationship; for instance, pre-orthodontic regenerative surgery facilitates bodily movements, while orthodontic repositioning can optimize defect access for grafting [13,53]. Survey studies reveal variations in clinical preferences, with orthodontists favoring early referrals for soft tissue augmentation in thin biotypes, yet underscoring gaps in standardized guidelines [54, 55]. Risk control remains paramount, as adult cohorts exhibit heightened vulnerabilities to resorption and relapse due to age-related diminished cellular activity [56, 57]. Enhanced hygiene regimens, appliance selection (e.g., aligners over brackets for superior plaque control), and TADs for anchorage exemplify evidence-based mitigations, corroborated by meta-analyses showing favorable periodontal indices with clear aligners in compromised patients [58, 59].

Limitations inherent to this narrative review merit acknowledgment. The reliance on studies from 2020-2025, while ensuring currency, may exclude foundational works, potentially overlooking longitudinal insights from earlier cohorts [60]. Heterogeneity in study designs—ranging from RCTs to case reports—poses challenges in generalizability, particularly for underrepresented demographics like geriatric adults or those with systemic comorbidities [61, 62]. Moreover, the absence of quantitative meta-analysis limits statistical robustness, though thematic synthesis provides practical clinical guidance [63]. Bias risks, such as publication favoring positive outcomes, could inflate perceived benefits, necessitating cautious interpretation [64].

Clinically, these findings advocate for multidisciplinary teams, leveraging digital tools like CBCT for precise planning and monitoring [65, 66]. Economically, integrated care may reduce overall treatment duration and costs, though prospective health economic studies are warranted [67]. Ethically, informed consent must emphasize potential risks, ensuring patient autonomy in decision-making [1,3].

In summation, the discourse affirms that interdisciplinary ortho-perio management, when timed and sequenced judiciously with rigorous risk controls, yields superior outcomes in adult patients, transforming periodontal compromise from a contraindication to an opportunity for restorative enhancement [2,4,6].

Conclusions and Future Directions

This narrative review elucidates the multifaceted interdisciplinary approach to orthodontic-periodontal management in adults, emphasizing that optimal timing (3-6 months post-stabilization, or earlier in select cases), strategic sequencing (periodontal health preceding mechanics), and proactive risk control (light forces, hygiene protocols) are instrumental in achieving aesthetic, functional, and periodontal

longevity [1-5]. Key takeaways include the imperative for pre-treatment inflammation resolution, biomechanical tailoring to altered anatomy, and continuous collaboration to avert complications like recession or mobility [6-10]. Ultimately, when inflammation is managed, orthodontics can beneficially remodel the periodontium, improving cleanability and stability without net detriment [11-13]. Future directions should prioritize high-quality RCTs comparing early versus delayed protocols in diverse populations, incorporating biomarkers for personalized risk stratification [53-55]. Advances in regenerative biologics, such as growth factors or stem cell therapies, hold promise for enhancing bone support pre-orthodontics, warranting integration studies [56-58]. Digital innovations, including AI-driven treatment planning and telemonitoring for compliance, could streamline interdisciplinary workflows [59-61]. Longitudinal cohorts tracking post-retention periodontal health over decades are essential to validate long-term efficacy [62-64]. Additionally, educational initiatives fostering ortho-perio synergy in training programs will bridge knowledge gaps, while health policy research could advocate for insurance coverage of combined therapies [65-67]. By addressing these avenues, the field can evolve toward precision medicine, optimizing outcomes for the burgeoning adult orthodontic demographic.

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