Chapter 3

Multidisciplinary Treatments And Current Approaches In The Orthodontic-Restorative Interface

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Abstract

The collaboration between orthodontic and restorative dental treatment is crucial to ensure their ideal results. This partnership aims to integrate orthodontic alignment with restorative procedures to achieve functional and aesthetic dental results. This collaboration is especially important when addressing complex dental cases involving misalignment, crowding, or spacing that require both orthodontic correction and restorative solutions. By properly aligning the teeth before or after the restorative procedure, orthodontists create an ideal foundation for the restorative workflow, removing as little material as possible from healthy dental tissues, ensuring the long-term success and durability of treatments. This multidisciplinary approach not only improves patient satisfaction, but also prevents complications, resulting in better oral health and stability. In conclusion, orthodontic-restorative collaboration plays an important role in modern comprehensive dental care.

Introduction and Conceptual Framework for Interdisciplinary Orthodontic and Restorative Treatment

In contemporary dentistry, the integration of orthodontic and restorative treatment modalities has emerged as a cornerstone for achieving optimal outcomes in both function and aesthetics. As early as the late 20th century, a multidisciplinary approach was strongly advocated for managing cases involving complex dental needs (Kokich, 1997). With the advent of digital diagnostic tools, enhanced communication systems, and collaborative treatment planning platforms, the predictability and efficiency of such interdisciplinary care have significantly improved. Orthodontic intervention

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plays a pivotal role in positioning teeth to complement future restorative procedures, ensuring preservation of dental structures while simultaneously addressing esthetic concerns.

However, the inherent complexity of merging orthodontic and prosthetic disciplines presents challenges—particularly in treatment sequencing, communication among specialists, and case-specific customization. Overcoming these barriers requires a structured, principle-driven planning model that fosters collaboration and ensures patient-centered care.

Drawing on the systematic methodologies proposed by Ray Dalio, five interdisciplinary principles have been adapted to streamline decision-making and enhance coordination in orthodontic-restorative treatment planning (Dalio, 2018). These principles not only guide clinical logic but also serve as a safeguard against treatment inconsistencies.

1. Core Principles Guiding Interdisciplinary Orthodontic and Restorative Therapy

A successful interdisciplinary approach relies on adherence to the following five core principles:

1. **Collaborative Planning with Active Participation**: Effective interdisciplinary treatment begins with input from both clinicians and patients, establishing shared goals and clearly defined expectations from the outset.
2. **Functional and Aesthetic Integration**: The treatment plan must harmonize aesthetic objectives with functional occlusion to achieve long-term stability and patient satisfaction.
3. **Predictive Digital Simulations**: Advanced planning tools, including digital mock-ups and 3D treatment simulations, are employed to visualize outcomes and refine the treatment sequence.
4. **Phased, Sequential Execution**: Treatments are organized into structured stages according to dental, skeletal, and soft tissue conditions, allowing each discipline to contribute optimally.
5. **Sustained Communication throughout Treatment**: Transparent and consistent communication among all members of the clinical team—and with the patient—is maintained throughout the process to minimize risk and enhance coordination.

2. Structured Workflow in Interdisciplinary Treatment Planning

To operationalize these principles, interdisciplinary orthodontic-restorative planning typically follows a four-phase workflow:

1. **Comprehensive Examination**: Initial clinical evaluation includes both subjective components (patient concerns, expectations, compliance potential) and objective assessments (intraoral and extraoral findings, caries risk, periodontal condition, and occlusal relationships).
2. **Diagnostic Data Integration**: A wide array of diagnostic records—ranging from 2D photographs and video footage to 3D digital scans and radiographic data—are compiled and analyzed to develop an accurate diagnosis.
3. **Problem Identification and Goal Setting**: Based on the clinical findings, a case-specific list of problems is defined, followed by a formulation of measurable, phased treatment goals (Grembowski, 1991).
4. **Implementation and Monitoring**: The interdisciplinary treatment plan is applied in stages, with scheduled re-evaluations and coordinated communication among specialties and with the patient.

3. Comprehensive Clinical Examination

A thorough clinical examination marks the foundational step in interdisciplinary orthodontic-restorative treatment planning. It comprises both subjective insights—rooted in the patient's concerns, expectations, and treatment compliance—and objective assessments involving structured evaluations across all three anatomical planes.

- **Sagittal plane**: Analyze molar and canine relationships, overjet, and maxillomandibular alignment.
- **Vertical plane**: Assess overbite and vertical proportions.
- **Transverse plane**: Evaluate midline deviations and anterior/posterior crossbites.

Caries risk and periodontal health must also be appraised to determine the viability of orthodontic intervention (American Dental Association, 2024; Dalio, 2018).

A detailed occlusal evaluation includes:

- Inter- and intra-arch contacts

- Anterior guidance (Schuyler, 2001)
- Fremitus and mobility
- Tooth position anomalies (rotation, impaction, overeruption)
- Occlusal planes (Spee and Wilson)
- Discrepancies between centric occlusion and maximum intercuspation (DiBiase, 2001; Kerosuo, 1995)

A structured checklist for these parameters enhances clinical consistency and sequencing logic.

4. Diagnostic Records and Aesthetic Considerations

A precise and multidisciplinary treatment strategy requires the integration and thorough interpretation of comprehensive diagnostic records. These records, which form the foundation of accurate diagnosis and planning, are typically categorized into five main groups:

1. Three-Dimensional Records Include digital intraoral scans, CBCT or conventional radiographs mounted on articulators using facebows or centric relation records, as well as physical study casts.
2. Video Recordings Capture real-time functional parameters such as lip mobility, speech articulation, and spontaneous smiling dynamics.
3. Two-Dimensional Photographs Standardized extraoral and intraoral images are used for symmetry analysis, arch form evaluation, and profile assessment.
4. Patient Questionnaires Structured forms assessing lifestyle behaviors, sleep quality, diet, and other behavioral factors that may influence treatment planning.
5. Consultation and Medical Reports Includes external letters from medical professionals, sleep studies, or interdisciplinary correspondence.

These datasets must be collectively reviewed by the interdisciplinary team. Beyond structural considerations, aesthetic diagnostics—including smile line evaluation, tooth dimension ratios, and Bolton analysis—play a crucial role in refining the treatment plan.

4.2.Aesthetic Parameters in Smile Design

Three key categories determine ideal smile esthetics:

1. Facial Parameters

- Facial Symmetry and Midline Alignment: The maxillary central incisors should ideally align with the facial midline (Sarver, 2007).
- Lip Dynamics: The position of the upper lip at rest and during smiling influences gingival and incisal display.
- Smile Arc: The incisal curve of the upper teeth should harmonize with the curvature of the lower lip (Frush, 1958).
- Demographics: Greater incisor visibility is generally preferred in younger and female patients, with a more conservative display favored in older or male individuals (Vig, 1978).

2. Mucogingival Parameters

- Gingival Exposure: A display of 1–2 mm gingiva above central incisors is considered esthetically optimal (Hunt, 2002).
- Gingival Margin Symmetry: Ideal cases feature horizontally aligned gingival margins for central incisors and canines, with laterals slightly apical (Sarver, 2007).
- Smile Line Considerations: In patients with high lip lines and anterior tooth loss, restorative challenges increase.
- Tissue Architecture: Severe hypodontia can result in soft tissue deficiency, complicating prosthetic integration (Khalaf & Wong, 2006).

4.3. Dental Parameters

- Tooth Characteristics: Esthetics depend on the harmonious integration of tooth size, shape, alignment, surface texture, and color (Levin, 1978).
- Proportional Balance: In hypodontia or microdontia, spacing often requires orthodontic redistribution prior to restoration.
- Golden Ratio (1:1.618): While sometimes used to guide anterior proportions, its routine application is controversial due to anatomical and cultural variability (Sarver, 2007; Magne, 2003; De Castro, 2006).
- Measurement Strategy: Perceived tooth width should be measured via frontal photographic analysis rather than intraoral methods, especially given arch curvature.

4.4. Clinical Implications

Relying strictly on numerical guidelines like the golden ratio can result in unnatural esthetic outcomes. Instead, treatment should be individualized—grounded in patient-specific anatomical features, esthetic expectations, and cultural considerations. Esthetic decisions should aim for natural harmony rather than formulaic perfection, supported by thorough diagnostic evaluation.

5. Treatment Planning: Problem Identification and Objective Structuring

A critical component of interdisciplinary orthodontic-restorative care is the systematic identification of clinical discrepancies. The process begins with the formulation of a detailed problem list, which highlights deviations from functional or aesthetic norms. This list serves as a blueprint from which targeted, measurable treatment objectives are derived.

In integrated orthodontic-restorative planning, two overarching goals define treatment direction: achieving aesthetic harmony and establishing functional occlusion. The latter is generally interpreted through the lens of *mutually protected occlusion*, wherein stable, simultaneous bilateral contacts are established in the posterior segments while the condyles reside in a musculoskeletally stable position. Functional forces are directed along the long axes of the teeth, and the anterior segment provides guidance and protective separation during excursive movements.

To visualize and refine treatment strategies, simulation tools are routinely employed prior to intervention. These may take the form of traditional wax-ups or contemporary digital mock-ups (Kesling, 1945; Hou et al., 2020). By previewing potential outcomes, clinicians can adjust orthodontic and restorative phases to align with functional and cosmetic targets.

Recent advancements in digital dentistry have expanded simulation capabilities, enabling clinicians to design multiple scenarios rapidly and with high precision. Orthodontic simulation software excels at modeling tooth movements but typically lacks restorative-specific functionalities such as prosthetic contouring. Conversely, restorative platforms (e.g., ExoCAD, Digital Smile Design) are optimized for prosthetic planning but do not support dynamic orthodontic adjustments.

Therefore, in most interdisciplinary workflows, simulation begins within orthodontic software to model movement and spacing, and digital data are subsequently transferred to restorative platforms to finalize prosthetic

elements. This dual-software strategy ensures comprehensive visualization of both treatment components.

However, for a simulation to be clinically meaningful, it must be preceded by:

- A thorough clinical examination
- Comprehensive diagnostic record review
- A collaboratively constructed problem list
- Clearly defined, realistic treatment objectives

Failure to establish these elements before simulation can result in misaligned treatment expectations, redundant planning steps, or compromised outcomes. Efficient, evidence-based planning thus depends not only on digital tools, but also on clinical insight and interdisciplinary consensus.

6. Implementation of the Treatment Plan and Interdisciplinary Communication

The execution phase of interdisciplinary orthodontic-restorative care is grounded in the priorities established through diagnostic evaluation and problem list formulation. Treatment sequencing is tailored to the final restorative objectives, with orthodontic interventions often preceding prosthetic steps to ensure optimal spatial and structural alignment.

Depending on the individual case, restorative interventions may be necessary:

- Before orthodontics (e.g., provisional build-ups to influence tooth movement),
- During treatment (e.g., management of space distribution),
- Or following orthodontics (e.g., reshaping, restoring natural form, or prosthetic replacement of missing teeth).

Typical restorative strategies integrated at various treatment phases are summarized in Table 1.

As orthodontic therapy approaches completion, the original pre-treatment checklist should be revisited to verify whether defined goals—both aesthetic and functional—have been achieved. This ensures alignment between initial planning and final outcomes.

Central to this phase is effective communication. Coordination among the orthodontist, restorative dentist, and other involved specialists—both at the planning stage and during each procedural transition—is essential. Miscommunication at any point may lead to duplicated efforts, extended treatment time, or suboptimal results. Therefore, structured team meetings and shared documentation systems are strongly recommended throughout the course of care.

Table 1. The treatment planning process.

Patient Factors	**Orthodontic Factors**	**Dental Factors**	**Soft Tissue Factors**
- Patient requests - Medical history - Development stage - Oral hygiene - Patient age (growth stage) - Cost -Concern of invasive procedures	- Skeletal pattern - Tooth/tissue ratio -Overbite crowding/ distance - Overjet - Need for anchors	- Tooth shape/size - Alveolar crest width	- Gingival biotype - Lip line

7. Space Management in Cases of Hypodontia or Tooth Size Discrepancy

In cases involving congenitally missing teeth or significant size discrepancies (e.g., microdontia), space management becomes a key decision-making component. The interdisciplinary team must determine whether to:

- Close the space orthodontically, creating a natural, gap-free arch form; or
- Maintain or open the space, enabling prosthetic replacement of the missing tooth or reshaping of adjacent teeth.

This decision is influenced by multiple clinical, skeletal, and esthetic parameters. In cases where microdontia is present, space redistribution may be necessary before final restorative procedures can be performed. The approach must balance occlusal harmony, facial esthetics, periodontal health, and long-term prosthetic viability.

The clinical criteria that guide this decision-making process are outlined in Table 2.

Table 2. Factors influencing the decision to open or close the space.

Open the Space Orthodontically	Close the Space Orthodontically
Cases with class 3 skeletal pattern Cases without crowding of the dentition Large discolored canines are present Aesthetic demands of the patient Stable class 1 buccal segment Hypodontia located in the quadrant jaw Premolars in the same mandible with a poor long-term prognosis Unilateral lost or missing lateral tooth Cases where canine tooth guidance is desired to be maintained	Class 2 skeletal pattern Crowding requiring extraction Small light-colored canine Missing lateral incisors (preservation of symmetry)

8. Closing the Space: Canine Substitution for Missing Maxillary Lateral Incisors

In cases where the maxillary lateral incisors are congenitally absent, one frequently employed approach is orthodontic space closure via canine substitution. In this technique, the maxillary canine is moved mesially to occupy the lateral incisor position, while the first premolar assumes the canine role in the arch (Armbruster et al., 2005; Louw & Evans, 2007; Zachrisson, 2011).

However, this repositioning requires significant morphological and esthetic modifications to both the canine and the first premolar in order to simulate the appearance and function of the teeth they are replacing. The canine, in particular, presents several challenges when substituted for a lateral incisor:

- Increased mesiodistal and buccopalatal width
- Greater crown length
- More coronal gingival margin
- Pronounced labial contour
- Typically darker enamel shade

To overcome these discrepancies and achieve a natural appearance, selective enamel reduction and crown reshaping are essential. This can be performed before or during the orthodontic phase, typically using fine-grit diamond burs and abrasive discs under water-cooled conditions. Enamel reduction is usually concentrated on the distal surface, which is naturally

more convex, to reduce width and enhance incisor-like morphology (Tuverson, 1970; Zachrisson, 1975).

Studies have shown that maxillary canines may exceed lateral incisor width by 1.0–1.5 mm (Tuverson, 1970; GC, 1993), necessitating targeted enameloplasty. Reduction on the mesial, distal, and labial surfaces may be indicated in select cases to harmonize form and occlusion. Importantly, controlled enamel reduction has not been associated with long-term pulpal damage when performed judiciously (Zachrisson, 1975).

To address postoperative dentinal sensitivity, topical fluoride varnish—such as Duraphat®—should be applied to the treated surfaces. While irreversible, this method is considered safe and effective when applied with precision and careful case selection.

The indications, benefits, and limitations of canine substitution as a space closure method are summarized in Table 3, while Figure 1 illustrates crown modification zones.

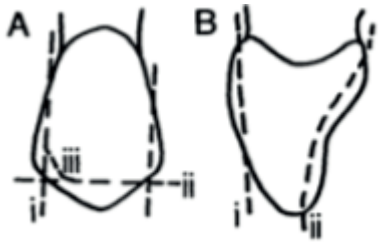

Figure 1. Modification of canines with grinding (A) (i) Interproximal reduction should be greater distally to flatten the natural distal projection of the canine. (ii) The tip of the canine should be reduced to a level slightly shorter than the central incisor. (iii) Incisal angles should be rounded, distal more than mesial. (B) (i) Reduction of the labial surface. (ii) Reduction of the palatal surface.

Table 3. Advantages and disadvantages of space closure. adapted from zachrisson et al. (Zachrisson B, 2011)

Advantages of Space Closure	Disadvantages of Space Closure
• Permanence of the finished result and the ability to complete treatment in early adolescence due to a simpler restorative approach • Early mesial movement of the canine tooth preserves the alveolar bone height in that area • It can eliminate the need for prosthetic dental treatment. • Minimally invasive resin restorations interfere less with the dental tissues. • Excellent aesthetic results can be achieved using modern restorative techniques. • It can be accepted by patients.	• The timing of orthodontic and restorative treatments should be determined very carefully considering the possibility of relapse. The tendency for the space to reopen should not be ignored. Keeping the teeth in the same position is very critical. • When the teeth are brought closer together in the anterior region, it may cause deviations in the upper incisor inclinations, and it also flattens the profile appearance. • The forms of the canines may not be suitable for aesthetic modification in some cases. • The dental arch narrows, which may cause dark buccal corridors when smiling. • Group function may occur in laterotruv movements or the functional occlusion requiring guidance in the first premolars may change. • Resin-based restorations may fail over time and must be kept under control, requiring routine maintenance and polishing.

In cases where maxillary canines are substituted for missing lateral incisors, morphological discrepancies such as increased crown width, darker color, and prominent labial ridges must be addressed. If enamel reduction alone does not yield satisfactory esthetic results, composite additions offer a conservative alternative (Figure 2). In select cases, ceramic veneers may be more appropriate depending on esthetic expectations.

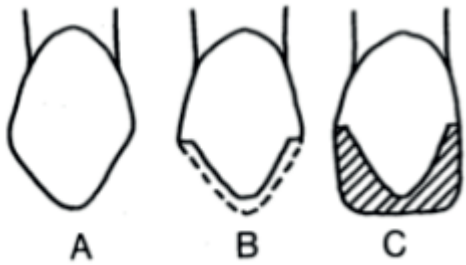

Figure 2. Modification of canines by composite additions. (A) Unmodified canine. (B) Reduction of half of the enamel thickness from the incisal third of the canine. (C) Composite added to reshape the canine to resemble an incisor.

These modifications are ideally performed during active orthodontic treatment—either pre-bonding or mid-treatment—so that tooth positions can be coordinated with the restorative contour, and space closure adjusted accordingly. Delaying contour correction until the end of treatment may complicate masking the canine's natural form.

Because canines often have a pronounced palatal cingulum and convex labial profile, their buccopalatal thickness should be reduced to avoid occlusal interference and exaggerated prominence. Enamel reduction, especially on the distal and labial surfaces, also helps refine crown shape and reduce width (Tuverson, 1970). Studies show that moderate reduction (1–1.5 mm) is safe and does not compromise pulpal health (Zachrisson, 1975). When enamel is thinned, the darker dentin may become visible, necessitating tooth whitening. Topical fluoride (e.g., Duraphat®) should be applied after grinding to prevent sensitivity.

If gingival margins are asymmetrical, orthodontic extrusion of the canine can lower the gingival zenith to align with central incisors. Simultaneous incisal edge reduction minimizes occlusal interference and supports a harmonious smile arc (Rosa, 2001).

When first premolars are used to mimic canines, bracket placement is essential. A slight distal offset induces mesial rotation, helping to conceal the palatal cusp and expand mesiodistal width (Zachrisson, 1975). Crown height discrepancies can be managed via vertical bracket positioning. Intrusive placement brings the gingival margin apically and repositions the palatal cusp, but may require occlusal restoration (Figure 3). Alternatively, gingival bracket placement extrudes the premolar, which may improve esthetics in low-smile-line patients, but could necessitate gingivectomy in high-smile-line cases.

In both strategies, the palatal cusp may require selective grinding to prevent occlusal conflict. If more buccal prominence is desired, controlled buccal torque can be applied, though care must be taken to avoid root displacement.

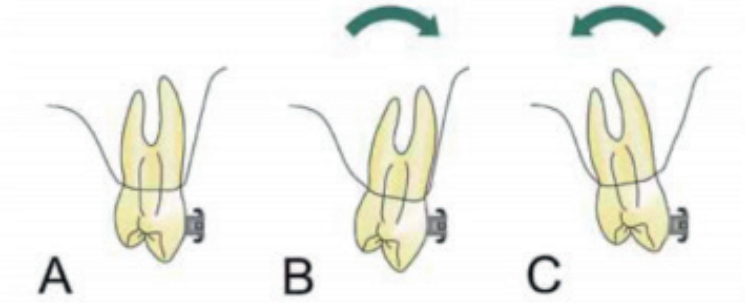

Figure 3. Shows the effects of changing the vertical position of an orthodontic bracket placed on the first premolar. (a) Bracket in the correct position for the maxillary first premolar. (B) Bracket placed in a more gingival position, resulting in extrusion of the tooth and some degree of buccal root torque. (C) Bracket placed in a more incisal position, resulting in intrusion of the tooth, which in turn causes some degree of palatal root torque, vertically lowering the palatal cusp. Permanence of the finished result and the ability to complete treatment in early adolescence due to a simpler restorative approach.

9. Opening the Space

The amount of space to be created for a missing anterior tooth—particularly a maxillary lateral incisor—is determined by a combination of occlusal relationships, tooth size proportions, and esthetic requirements. From an esthetic perspective, the space required for a lateral incisor is influenced by the width of the contralateral lateral incisor and the dimensions of the adjacent central incisors. In general, the lateral incisor should approximate two-thirds the width of the central incisor, a proportion commonly referenced in smile design and sometimes linked to the "golden ratio" (Schuyler, 2001).

In many cases, the opposing lateral incisor is peg-shaped, making symmetry more difficult to achieve. Therefore, treatment planning should involve both the creation of adequate space for the missing tooth and the restoration of ideal dimensions for the peg-shaped contralateral incisor. Attention must also be given to maintaining the dental midline, which plays a pivotal role in facial esthetics and occlusal balance.

In individuals with peg-shaped lateral incisors, composite build-ups are often the preferred method for reshaping. This conservative technique allows the tooth to be restored to a more natural size with minimal invasiveness. To optimize restorative outcomes, the orthodontist should position the lateral

incisor centrally within the allocated space, so that composite can be applied symmetrically on both the mesial and distal surfaces. This enhances the emergence profile, crown contour, and anatomical proportions (Figure 4).

Despite its benefits, restoring a peg-shaped lateral incisor presents challenges. Anatomical inconsistencies between the root structure, cervical margin, and crown size may increase the risk of stress concentration at the cervical region following restoration. This may predispose the tooth to marginal fractures or compromise the longevity of the composite restoration.

If there is a greater need for space redistribution in the maxillary arch, extraction of peg-shaped lateral incisors may be indicated. In such cases, bilateral extraction helps preserve midline symmetry. This option is particularly effective when implemented before the eruption of maxillary canines, allowing the canines to drift into the lateral incisor position naturally and be later modified esthetically.

However, if the peg-shaped incisors do not pose significant esthetic or functional concerns, and if occlusion remains stable, leaving them untreated may also be a viable option, particularly in patients with low esthetic expectations or limited restorative demand.

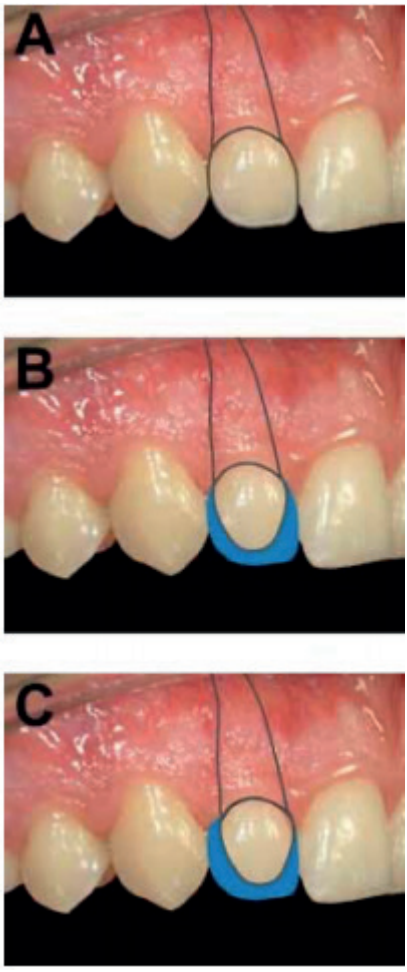

Figure 4. Proper Alignment of the Peg-Shaped Lateral Incisor Before Composite Build-Up (A) Ideal Aesthetic Proportions: A harmonious restoration of a lateral incisor requires adherence to proportional width-to-height relationships that are consistent with adjacent teeth, especially the central incisor and canine. Achieving this balance is key to establishing a natural and esthetically pleasing appearance. (B) Centrally Aligned Peg-Shaped Lateral Incisor: When the peg-shaped lateral is accurately positioned in the center of the edentulous space, composite can be symmetrically distributed on both the mesial and distal surfaces (indicated in blue). This facilitates an anatomically correct emergence profile and optimizes esthetic integration with adjacent teeth. (C) Mesially Mispositioned Peg Lateral: If the tooth is placed too close to the central incisor, restorative space becomes uneven. As a result, composite must be disproportionately added to the distal surface (indicated in blue), leading to an imbalanced contour. This

may compromise esthetics and result in a convex ridge prone to plaque accumulation, thereby affecting both function and hygiene.

Conclusion

Successful orthodontic-restorative treatments rely on seamless interdisciplinary collaboration. Strategic task distribution among team members, along with consistent and clear communication, is essential at every stage of care. Coordinating the timing and sequencing of orthodontic and restorative phases not only improves treatment efficiency but also enhances both functional stability and esthetic outcomes. When planned and executed in harmony, interdisciplinary approaches offer patients a comprehensive path toward long-term oral health and satisfaction.

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