Treating Two Adjacent Missing Teeth in the Esthetic Zone

Part 1: The Pink Hybrid Restoration and the Unilateral versus Bilateral Defect Concept

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Abstract

This article, the first of a planned three-part series, outlines a new surgical and prosthetic approach for treating cases involving two missing adjacent teeth in the esthetic zone. These types of cases, particularly when combined with a three-dimensional ridge deficiency, represent one of esthetic dentistry's most challenging dilemmas. A clear understanding of the unilateral and bilateral defect concept is necessary to properly evaluate each particular case, understand surgical limitations, perform a better risk assessment, establish an esthetic prognosis, develop the best clinical-laboratory strategy, and adjust patients' expectations. While not recommended for every case, the pink hybrid restoration technique, when planned from inception, represents a useful, economical, and predictable alternative that decreases the number and complexity of interventions.

Key Words: bilateral defect, unilateral defect, ridge deficiency, ridge enhancement, inception, interface



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Introduction

Replacing missing teeth in areas of anterior ridge deformities represents one of esthetic dentistry's most significant challenges. Adding to the difficulty for treating dentists and technicians are increased patient demands and expectations for esthetic results when dental implant therapy is incorporated as the standard treatment for lost dentition.

As the first part of a planned three-part series offering insights into the pink hybrid restoration (PHR) treatment-planning and decision-making process, this article presents two unilateral partial defect cases (i.e., two missing adjacent teeth in the esthetic zone), including one with three-dimensional (3D) ridge deficiencies in which a new surgical and prosthetic treatment approach is undertaken. To empower clinicians with the necessary knowledge to make the most appropriate and informed treatment decisions, it addresses the limitations, advantages (e.g., offering patients more economical, shorter, and less painful procedures), and disadvantages (e.g., space and mechanical limitations, integration issues, and hygiene difficulties) of available options. Specifics about clinical and fabrication protocol and decision making will be discussed in the series' subsequent parts.

Anterior Esthetic Challenges

Among the challenges that may be encountered when restoring anterior esthetic implant cases after major hard and soft tissue loss are the following:

- Achieving ideal ridge enhancement.
- Achieving ideal papilla redevelopment, primarily between two missing teeth when the goal is to match the remaining natural contralateral papilla.
- Achieving ideal tooth morphology when the objective is to match the remaining natural contralateral teeth.
- Managing mesiodistal space when the space is less or more than ideal (having less space is common in healed sites because, after tooth loss, adjacent teeth tend to move towards closing the gap). Space management can be exacting, not only when reproducing white (i.e., tooth/restoration) and pink (i.e., gingival) esthetics, but also when trying to ideally distribute the space between natural roots and implants. In certain cases, although two teeth may be missing, the resulting edentulous space may be insufficient for placing two implants due either to the size of the actual space between the adjacent teeth, or to root inclination, which can decrease the apical space for the implants.

Published evidence¹ indicates that although ridge augmentation procedures are performed to resolve these issues, a considerable number of patients treated in this manner do not receive the ideal soft tissue height and position. The predictability of the final esthetic result is more often determined by the patient's anatomy than by the clinician's ability to manage state-of-the-art surgical procedures.^{2,3} As a result, it is not uncommon to perform multiple ridge augmentation procedures yet still not achieve ideal soft tissue architecture, thereby compromising the esthetic design of the restoration and the patient's ability to smile confidently.

For this reason, cases involving total defects restored with a fullarch white and pink prosthesis do not pose a major challenge, since the interface between natural and artificial pink is hidden (i.e., camouflaged) behind the upper lip. In fact, cases in which all upper or lower teeth are missing allow technicians and clinicians almost complete freedom to create the teeth and gingiva in the proper proportions (Fig 1). However, with a partial defect in the esthetic zone, the pink interface is visible, making the case much more difficult, clinical choices much more critical, and camouflaging the interface much more challenging when artificial pink is required.

Unilateral Versus Bilateral Partial Defects

Partial defect cases can be categorized as either *unilateral* or *bilateral*. Unilateral defect cases (e.g., a central and lateral are missing) (Fig 2) pose a greater challenge than bilateral defect cases (e.g., those in which the two centrals, or both centrals and both laterals are missing) (Figs 3-5). Although the same number of teeth and volume might be missing in both case types, a unilateral defect is of greater concern due to the visual esthetic comparison with the preserved contralateral side (Figs 6-8).

In fact, probably the most challenging situation when restoring the esthetic zone is the missing central/lateral case type, primarily because the contralateral side provides the natural reference that is extremely difficult to match. Typically, the papilla between the missing central and lateral creates the esthetic limitation. The soft tissue biotype and shapes of the tooth and papilla of the contralateral side dictate the degree of challenge. For example, thin tissue and triangular tooth shape with long papillae create a more problematic scenario than one involving thicker biotypes with rather square teeth. Nevertheless, most tooth forms are combined and not pure,⁴ making adjustments easier when sufficient teeth are included, allowing for more favorable emergence profiles.

Note, however, that although reconstructions of bilateral defects after ridge augmentation and implant placement may not completely recover missing papillae volume (an ideal papilla should have 30 to 50% of the tooth's height),⁵ the outcome can still be esthetically pleasing because there is no contralateral side for visual comparison (Figs 9 & 10). Working with the properties of optical illusion, an experienced technician can experiment with line angles and embrasures to mask the papilla's lack of ideal volume and length without distorting the restoration's appearance (Figs 11 & 12).⁶



Figure 1: Example of a symmetrical complete defect. Because the entire maxilla is reconstructed, there are fewer limitations. Papillae can be reconstructed, tooth proportions maintained, and when there is sufficient space, the likelihood for natural integration is high. (*Restorative work by Mauro Fradeani, DDS; ceramics by Juvenal de Souza, CDT*)



Figure 2: Example of an asymmetrical partial defect in which the challenge and limitations are much greater due to the need to make the teeth similar in size, shape, and pink integration compared to the sound contralateral side. (*Surgery by Maurice Salama, DMD; restorative work by David Garber, DMD; ceramics by Christian Coachman, CDT, DDS*)





Figures 3-5: Although a partial defect, the bilateral nature of missing teeth #7 through #10 presents no potential for visual contralateral esthetic comparison, making it easier to achieve an acceptable esthetic result even if the reconstruction is not ideal. (Surgery by Maurice A. Salama, DMD; prosthodontics by David A. Garber, DMD; ceramics and pink composite by Christian Coachman, CDT, DDS)



Figures 6-8: Although also a partial defect with the same number of missing teeth (#5 through #8) as the case shown in Figures 3-5, the unilateral nature of this defect creates a visual contralateral esthetic comparison, making it more challenging to achieve an acceptable esthetic result. Any imperfection in the reconstruction will be highlighted by comparison with the preserved side. (*Clinical work by Eric Van Dooren, DDS; ceramics and pink composite by Christian Coachman, CDT, DDS*)



Figures 9 & 10: Example of a symmetrical defect reconstructed at #8 and #9. Although the mesial papilla does not demonstrate the appropriate volume and height, the central position helps the restorations to blend more naturally. (*Clinical work by Eric Van Dooren, DDS; ceramics by Murilo Calgaro*)



Figure 11: Two characteristics of natural and beautiful papillae that make implant dentistry so challenging and that are usually lost when two or more adjacent teeth are missing are as follows: 1) When seen from a frontal view, natural papillae (top, green arrow) are 30 to 50% of the length of the tooth (top, red arrow). 2) When seen from an occlusal view, natural papillae present more buccal volume (bottom, green arrow) than the teeth (bottom, red arrow).



Figure 12: The two characteristics mentioned in Figure 11 are very difficult to restore completely even when grafting procedures are successful. These limitations are well seen in this case (four-unit anterior implant bridge from lateral to lateral), which, although it can be considered successful, shows a slight lack of length (top) but mainly shows the lack of volume when viewed from a diagonal angle.

By understanding the unilateral and bilateral defect concept, dentists and laboratory technicians can properly evaluate a particular case, identify surgical limitations, perform a more accurate risk assessment, and establish an esthetic prognosis. Doing so will also facilitate developing the best clinical-laboratory strategy and adjusting patient expectations.

For example, conventional surgical reconstruction may not always be the best alternative for the patient for various reasons (e.g., failure of prior surgeries to achieve acceptable results, patient refusal to undergo surgeries with unpredictable outcomes, high cost and length of treatment). For this reason, restoring ridge deficiencies prosthetically with materials that mimic natural gingiva represents an attractive alternative.⁶

Therefore, it behooves clinicians and technicians to fully understand all available options and their limitations, as well as where, when, and how to best utilize them. Among the options they can select is the PHR.

Prosthetically Addressing Partial Defects

Discussed extensively in a series of articles published in 2009 and 2010,⁶⁻⁸ the PHR presents a novel approach to prosthetically restoring partial defects that combines pink ceramics and pink composites. It is a viable option in cases with major volume loss for which grafting procedures could not be performed, failed, or did not meet esthetic expectations.⁶⁻⁸

Space management can be exacting, not only when reproducing white and pink esthetics, but also when trying to ideally distribute the space between natural roots and implants. Although a reasonable amount of evidence and experience has been gained since the original articles were published, there remains a lack of clear information about when and how to optimally use the technique. Clinicians and technicians should understand the following:

- The PHR must be screw-retained to enable maintenance and retrievability.
- Esthetic integration of a PHR is much better when composite is used due to the variety of colors available and the final direct intraoral application.
- PHR requires less maintenance when using just pink ceramics and not adding pink composite overlay. Therefore, whenever possible, one should try to solve cases esthetically only with ceramics. Pink composite should be added only when pink ceramics are not fulfilling the patient's esthetics needs.

Treatment Planning Pink Prosthetics from Inception

In some cases (e.g., when an inadequate number of implants have already been placed in less than ideal positions), the artificial pink option must be used as an "afterthought," when the likelihood of producing unpredictable results is greater. However, when the prosthetic option is selected to restore esthetics, the treatment plan should be modified and, ideally, the surgical procedures should adapt to accommodate a pink restoration.

Therefore, to increase the probability of being able to combine esthetics and hygiene (and thus produce a more favorable outcome), the treatment plan should instead incorporate the pink prosthetic option from inception and position the implants accordingly.⁷

The thought process for effective treatment planning from inception should be sequenced as follows:

- 1. Understand the defect three-dimensionally. Perform a clinical evaluation and carefully analyze the radiographs and computerized tomography scans. Another highly effective way to analyze the defect is to fabricate a white and pink diagnostic wax-up on which the teeth will be waxed in their ideal position. The waxup should be filled completely; ideally, the entire missing soft tissue area also should be filled with pink wax. This provides the clinician and technician with a good idea of the volume of missing tissue. Nowadays the white and pink design can be done digitally, with 3D software facilitating even more the process of creating a facially driven design and understanding the realistic defect volumetrically.
- 2. Evaluate possible solutions. For each option, consider risk assessment, advantages and disadvantages, and prognosis. Share these options and their specifics with the patient.
- 3. Plan appropriately. If the option is to utilize the PHR, the key is understanding where the interface between natural and artificial pink should be positioned. The pink diagnostic wax-up will indicate where this interface should be placed according to the smile line. If the smile line falls above the defect, one effective solution is to surgically remove some bone from the ridge. This enables the clinician to place the implant deeper and also hides the artificial and natural gingiva interface.⁸ The interface position will guide the surgical procedures (e.g., implant placement and grafts), if necessary.

Case Presentations

Case 1: Preserving and Enhancing the Ridge to Avoid Artificial Pink

Treatment plan: The patient presented with ceramic crowns over fractured roots on teeth #9 and #10 (Figs 13 & 14). The treatment plan was to preserve and enhance the soft tissue through surgical procedures (e.g., atraumatic extractions, soft and hard tissue grafts, and soft tissue conditioning) and restore with an implant bridge without artificial gingiva.

Treatment: The fractured teeth were extracted and one implant was placed to support a two-unit bridge. A bone substitute (Geistlich Bio-Oss, Geistlich Pharma North America Inc.; Princeton, NJ) was placed to fill the buccal gap; a connective tissue graft (CTG), removed from the palate, was also placed. To improve the pink esthetics, a second CTG was performed after healing from the first surgery (Figs 15 & 16).

After provisional placement and complete healing, a pink esthetic limitation was still evident compared to the unrestored contralateral side (Figs 17 & 18), and the patient was dissatisfied with the provisional design. The final bridge was fabricated with pink porcelain (Creation CC, Creation Willi Geller Int'l GmbH; Meiningen, Austria) as a supplemental means to try to improve the white and pink esthetics.

The pink porcelain solution was chosen as the best option because, although socket preservation, guided bone regeneration (GBR), and two CTGs were performed, the soft tissue level did not compare favorably to the natural contralateral side. (Note that all surgical interventions involve risks and are never completely predictable.)

The pink ceramics contributed to better tooth morphology, but the challenge was, as always, blending the artificial pink ceramics with the natural gingiva (Fig 19). The desired final outcome for a successful prosthetic restoration of partial defects is a hidden interface between the artificial pink ceramics and the natural gingiva when the patient gives a "social" or "half" smile (Fig 20).

Unfortunately, the patient had a very high lip line that revealed the interface of artificial and natural gingiva. The esthetic discrepancy between the beautiful, natural triangular papillae between the central and lateral on the patient's right side, and the short and flat papillae on the restored side that created an unattractive interproximal shadow, was obvious (Fig 21). In such cases, it is very difficult to produce a pink ceramic combination that can ideally match and hide the interface, and patients typically are not satisfied with a visible interface.



Figure 13: Preoperative view showing ceramic crowns on #9 and #10 in an area with a unilateral defect.



Figure 14: Preoperative radiograph showing fractured roots of #9 and #10.



Figure 15: The fractured teeth were extracted and one implant was placed to support a two-unit bridge.



Figure 16: Due to its unilateral nature, the case represents a much greater challenge for the clinician, since the asymmetrical nature of the defect presents an unavoidable comparison with the healthy contralateral side. (*Clinical work by Eric Van Dooren, DDS; provisionals by Christian Coachman, CDT, DDS*)



Figure 17: After provisional placement and full healing, the unilateral gingival defect makes the lack of papilla obvious and difficult to camouflage. (*Clinical work by Eric Van Dooren, DDS; provisionals by Christian Coachman, CDT, DDS*)



Figure 18: With provisionals in place, the pink esthetic limitation is still evident when comparing the restored side with the natural contralateral side.



Figure 19: The final bridge was fabricated with pink porcelain as an afterthought in an attempt to improve the white and pink esthetics.



Figure 20: The final outcome, left lateral view.



Figure 21: The patient's very high lip line reveals the interface between artificial and natural gingiva. (*Clinical work by Eric Van Dooren, DDS; provisionals and ceramics by Christian Coachman, CDT, DDS*)

Proposed adjustments: To remedy this patient's dissatisfaction, three options were considered:

- Performing additional surgical augmentation, which was decided against by both patient and surgeon.
- Distorting the shapes of the restorations to hide the defect with optical illusion (an attempt that was made unsuccessfully).
- Adding artificial pink material to the defect side to try to reproduce the attractive appearance of the contralateral natural side.

With challenging cases such as this in which the interface is visible and the pink ceramic inadequately matches the natural gingiva, the PHR technique is recommended.

Accordingly, an appointment was scheduled for the following week. At that time, blanching would be performed and tissue adaptation around the final restoration verified. Then, the bridge (i.e., the PHR) would be unscrewed, the surface etched, and a minimal amount of pink composite added to improve esthetic integration.

Esthetic outcome: Unfortunately, the patient never returned for the scheduled follow-up appointment, so the proposed solution was never completed. Because this restorative approach was not planned from inception, technical limitations, imperfect color matching, and a visible transition between the pink ceramic and the gingiva were present. Nevertheless, although still far from ideal—particularly considering upper lip line involvement—this late determination provided a reasonable esthetic solution that is preferable to leaving an obvious pink and white asymmetry.



Figure 22: Option 1: placing two implants, one on each future crown position.



Figure 23: Option 2: placing one implant with a mesial cantilever.



Figure 24: Option 3: placing one implant with a distal cantilever.

Case 2: Planning for Artificial Pink After Facing Limitations with Surgical Ridge Enhancement Procedures

Treatment plan: This patient presented with two missing adjacent teeth in the anterior esthetic zone (#7 and #8) and a more aggressive 3D defect after socket healing. The treatment strategy to resolve the defect, which was planned from inception, was to place an implant bridge with artificial gingiva created with pink ceramics and composites. In such cases, the three conventional options for the implant's mesiodistal position in the arch, each of which presents issues that must be analyzed when planning from inception for artificial pink, are as follows:

- Option 1: Place two implants, one at each future crown position (Fig 22). Two implants will make hygiene procedures more complex, since the spacing can sometimes present an issue if the mesiodistal distance of the gap is tight. Also, the design of the pink component is more challenging with more abutments, and pink esthetics are easier to develop in pontics than in abutments.
- Option 2: Place one implant with a mesial cantilever (Fig 23). The occlusal load will be away from the implant axis.
- Option 3: Place one implant with a distal cantilever (Fig 24). The occlusal load will be away from the implant axis, which is less critical than in Option 2, since the heavier load would be on the central, tooth #8.

In addition to load, the bone must also be considered when clinicians evaluate and select from these options for their particular case. As in the early years of implantology when clinicians placed implants where bone was best or simply available, pink esthetic restorations are meant to simplify the procedures; when bone is missing, the pink ceramic or composite will replace it. The tendency is to place the implant at the central because the bone typically tends to be thinner in the lateral area.

Treatment: In this case, the best conventional implant position for the pink restoration was the third option, with one implant at the central incisor position (Fig 24). After GBR and CTG healing, the defect was visible, with a noticeable lack of buccal volume and distance to the ideal position of the tip of the papilla (Figs 25-27).

...the most challenging situation when restoring the esthetic zone is the missing central/lateral case type, primarily because the contralateral side provides the natural reference that is extremely difficult to match.

A pink and white diagnostic wax-up was fabricated to provide good visualization of the real dimension of the 3D deficiency. The white aspects of the wax-up (i.e., crown restorations) were designed ideally in terms of tooth morphology and position in the arch to match the contralateral teeth as well as possible. Then the pink wax was used to fill in the entire volume of missing gingiva, also ideally according to the gingival design of the remaining natural soft tissue. This wax-up showed approximately where the artificial gingiva would meet the natural tissue (Fig 28).



Figures 25-27: The defect was visible after GBR and CTG healing. Note the lack of buccal volume and the distance to the ideal position of the tip of the papilla.



Figure 28: The pink and white diagnostic wax-up provided good visualization of the real dimension of the three-dimensional deficiency. (*Wax-up by Christian Coachman, CDT, DDS*)



Figure 29: A pink prosthetic option for ridge enhancement. (*Ceramics by Murilo Calgaro; pink composite by Christian Coachman, CDT, DDS*)



Figures 30 & 31: The postoperative retracted anterior view and radiograph demonstrate good integration between artificial and natural gingiva, as well as between ceramic crowns and natural dentition. (*Clinical work by Eric Van Dooren, DDS*; white ceramics by Murilo Calgaro; design, wax-up, and pink composite by Christian Coachman, CDT, DDS; composite on #9 by Claudio Pinho.)

Surgical guidelines: When determining the ideal 3D implant position for a pink restoration, there are three main surgical guidelines:

- 1. Use the minimum number of implants allowed by biomechanical principles, which facilitates hygiene and the bridge design.
- 2. Place the implant deeper, which contributes to establishing the ideal emergence profile and soft tissue contouring, as well as restricts the ridge lap of the bridge design.
- 3. Ensure a lingual/palatal inclination of the implant to allow lingual/palatal screw access. The pink bridge should always be retrievable for maintenance and soft tissue control issues. With the new angulated screw channel abutments, palatal screw access is now easier.

To prosthetically enhance the ridge, the PHR technique was used by adding direct pink composite on top of the pink ceramics. This improved the match between the natural and artificial gingiva (Fig 29).

Esthetic outcome: An esthetically pleasing outcome resulted from implant placement and CTG according to the PHR protocol. Only horizontal work was performed, and no vertical augmentation was attempted because the vertical component was restored with artificial pink. The bigger the vertical defect, the easier it is to develop and blend the pink prosthesis. A retracted anterior view of the definitive two-unit metal-ceramic implant bridge on #7 and #8 with ceramic (IPS d.SIGN, Ivo-

clar Vivadent; Schaan, Liechtenstein) and composite (Anaxdent/Anaxgum, Anaxdent North America; Ardmore, OK) and a radiograph showed good integration between artificial and natural gingiva, as well as ceramic crowns and natural teeth (Figs 30 & 31).

Discussion

In the two cases discussed, both patients presented with a high lip line that revealed their respective defects, and each expressed high esthetic demands. In Case 1, a prosthetic solution with only ceramics was incorporated as an afterthought. In Case 2, the PHR included pink composite from inception.

The prosthetic option was chosen as the best possible solution in Case 1 because—although socket preservation, GBR, and two CTGs were performed—the gingival size and volume, particularly of the papilla, were inadequate. All of these procedures were originally undertaken to avoid artificial pink in the prosthesis.

Due to the unilateral defect aspect of Case 1, well-performed grafting procedures were insufficient to create acceptable esthetics. Many attempts were undertaken during provisional design to camouflage the defect through optical illusion, but ultimately it was necessary to add pink porcelain to create a look that satisfied the patient's esthetic demands. The use of pink ceramics produced optimal results.

Unfortunately, because it was impossible to achieve a perfect transition between the pink ceramic and the gingiva, the final outcome was not ideal; the treatment had not been planned at inception to account for the unavoidable unilateral defect using artificial pink, thereby magnifying the challenges.

Conversely, Case 2 demonstrated realization of the PHR when planning the pink porcelain and composite is incorporated from inception. It accounted for the limitations of GBR and CTGs, enabling ideal implant placement and fewer surgical interventions, lower costs, and less time; and resulted in a considerably better esthetic outcome, even though the defect was significantly greater than the one in Case 1. Because of these factors, even though the soft tissue gain and lack of papillae volume were similar in both cases, Case 2 resulted in a more esthetically pleasing outcome.

Summary

Clinicians and technicians should keep in mind that the PHR is not recommended for every case. However, it is sometimes the best option in cases with significant defects for which major soft and hard tissue grafts are necessary and results are unpredictable. The PHR must be planned from inception, since it must be screw-retained for hygiene considerations. When pink composite is used, retrievability plays an even more significant role, because the longevity of composites is clearly shorter than that of ceramics. In the authors' experience, the composite should be polished yearly, and partial or complete composite replacement might be necessary after three or four years.

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