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Treating Two Adjacent Missing Teeth in the Esthetic Zone

Part 3: The Pink Hybrid Restoration and the "In-Between" Implant Concept for the Anterior Maxill

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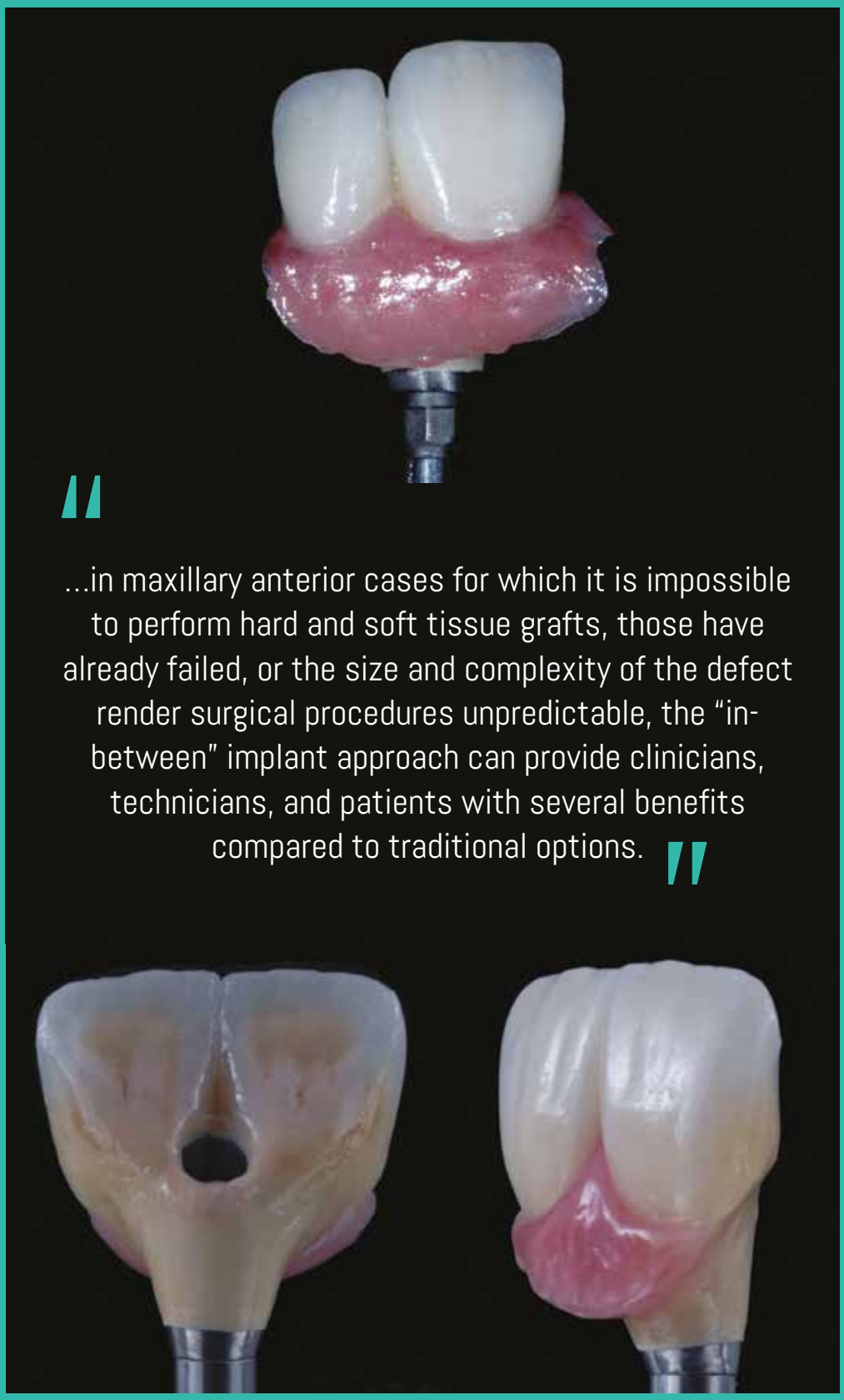
Abstract

The previous articles in this three-part series presented the rationale and considerations for pink hybrid restorations (PHR), as well as the importance of appropriate planning from inception. The first article discussed the relevance of unilateral versus bilateral defects, while the second article highlighted the "in between" implant concept for the anterior mandible, where limited space is a generally accepted rule. This third and final article in the series addresses the challenges, decision-making process, advantages, and special considerations for using the "in between" implant approach combined with the PHR technique in the anterior maxilla for cases presenting with unilateral and bilateral defects and where it is impossible to perform hard and soft tissue grafts, those have already failed, or the size and complexity of the defect make surgical procedures unpredictable.

Kew Words: "in-between" implants, anterior maxilla, unilateral defects, bilateral defects



> "...in maxillary anterior cases for which it is impossible to perform hard and soft tissue grafts, those have already failed, or the size and complexity of the defect render surgical procedures unpredictable, the "in-between" implant approach can provide clinicians, technicians, and patients with several benefits compared to traditional options."

Introduction

In the 1990s, clinicians frequently used Branemark prostheses (Nobel Biocare; Zurich, Switzerland) when placing implants between crown positions. This was not problematic; the prosthesis was metal-based and opaque, and the goal at that time was placing the implant in the best possible bone position, wherever bone was available, and not according to the prosthetic crown position. The "in-between" implant position, which is determined according to bone quality and places the implant in the middle of the space, was not necessarily desired and was planned only for full-mouth reconstructions.

Unfortunately, the anterior maxilla is probably the most challenging area to restore from an esthetic perspective. When major defects exist, grafting techniques often cannot completely recover the lost tissues. Additionally, many people—especially young females—present gingival display when they smile, accentuating any discrepancies in tooth shape and gingival volume or contours. Limited space, a classic complication in cases involving anterior mandibular defects, is rare in the maxilla. Instead, buccal bone resorption, lack of attached gingiva or bone, and soft tissue loss due to infections, fractures, or accidents are more typical. These complications were discussed at length in Part 1 and Part 2 of this three-part article series, as well as the original three-article series[1-3] and many other publications.[4-8]

Therefore, in maxillary anterior cases for which it is impossible to perform hard and soft tissue grafts, those have already failed, or the size and complexity of the defect render surgical procedures unpredictable, the "in-between" implant approach (i.e., replacing two adjacent missing teeth with a two-unit prosthesis supported by a single implant that is placed in the middle of the space) can provide clinicians, technicians, and patients with several benefits compared to traditional options. These include total cost reduction; fewer implants; less critical and unpredictable surgeries; reduced treatment time and fewer appointments; and a significantly improved patient experience (e.g., diminished discomfort associated with implant treatment and increased outcome predictability).

The "In-Between" Implant Approach

Although the "in-between" implant approach might at first seem contradictory to classic implantology and prosthodontic rules, it actually is not. However, clinicians and technicians are more likely to accept this implant placement approach for mandibular cases, since most of them have absolutely no space for two implants. In fact, in some cases the space might be even less (e.g., cases in which orthodontists must address extreme space deficiencies and restoration might only be a single crown, leaving the patient with three lower incisors). In such space-sensitive situations, a single, compact prosthesis shaped as two teeth represents the simplest and most reasonable space-saving solution.

Conversely, clinicians may be more inclined to resist the "in-between" implant placement approach for anterior maxillary cases even though the rationale for its use is the same. For example, the anatomical limitation and possible surgical complications presented by the incisive canal at the maxillary midline may concern clinicians planning to restore symmetrical defects in this area.

However, these challenges can be adequately addressed and prevented with careful attention to the specific indications and pre-treatment planning considerations for the "in-between" implant approach. Cone beam computed tomography can be used before planning the case to ensure sufficient buccal bone from the canal. Other considerations for treatment planning "in-between" implant placement from inception include:

- **Depth:** The implant position should always be deeper than the depth for a traditional single crown restoration (i.e., inside the bone crest and ensuring primary osseous integration).
- **Morphology:** The apex of adjacent teeth and interproximal bone must be considered. The "in-between" implant placement is indicated precisely in cases where there is convergence of the apex and sufficient interproximal bone.
- **Soft tissue esthetics:** Soft tissue conditioning is ideally performed with provisional restorations that incorporate both white (i.e., tooth/restoration) and pink (i.e., gingival) components (e.g., pink hybrid restorations [PHR]). Because the interface between the restoration and soft tissue is never perfect with ceramic, the pink component is refined after the white esthetics is achieved. Once the pink is ready, it is adjusted intraorally and pink composites are applied, when necessary.

Advantages of the "In-Between" Implant Concept Combined with the PHR Technique

Although it is true that prosthetic gingival restorations do require additional theoretical knowledge and technical skills from the treatment team to ensure continuity between the natural and artificial gingiva,[8,9] equally true is the possibility of achieving optimal outcomes. In particular, there are several advantages to employing the "in-between" implant approach in combination with the PHR technique. These include:

- **Function:** As a rule, the occlusal load is close to the implant position, which is in the middle of the restoration. Forces are more axial, and the creation of two half cantilevers reduces the load on the interfaces, connector, and implant screw when forces are applied at the restoration margins. Occlusal load distribution and hygiene are much better because the cantilevers are only half the size of a traditional one (i.e., the distance to the middle of the two half cantilevers is less than with a complete cantilever).
- **Biology:** Because fewer or no grafting procedures are required and surgical implant placement is simpler, the number of interventions is reduced and the patient's dis-

comfort is dramatically decreased. Afterwards, the hygiene process—the main disadvantage of the PHR technique—is much easier, since the pontics are only half the size of traditional ones.

- **Structure:** It is easier for technicians to make the frame and hide the screw when the implant is placed palatally. Additionally, creating the correct emergence profile and the PHR is simpler in pontics or "half pontics" than in abutments.
- **Esthetics:** The interproximal area, which requires more light, is easily created with the "in-between" implant approach, since the metal frame has a space between the teeth. The emergence profile of the pink ceramic is favorable with a deeper and more palatal placement, while the space created facilitates imparting color and opacity, since the metal frame begins at a more palatal position.
- **Extended applications:** The "in-between" implant approach can be extended to three-unit bridges (e.g., with two "in-between" implants) and to canines and premolars when artificial pink is required between prosthetic crowns. The "in-between" position also can present all of the above advantages when developing a full-arch implant bridge with artificial pink.

Case Presentations

The following clinical cases—one to restore unilateral defects where acute infection was present; the other to restore bilateral defects after previous periodontal and surgical treatments had failed—highlight the challenges, decision-making process, advantages, and special considerations for treatment planning the use of the "in-between" implant approach and PHR technique from inception in the maxillary anterior region.

Case 1: The "In Between" Implant Concept for Unilateral Defects

The patient presented with a unilateral defect at teeth #9 and #10, which were compromised by significant bone and soft tissue defects primarily in the interproximal and buccal areas **(Figs 1 & 2)**. Planned treatment involved extraction of #9 and #10 **(Fig 3)**, delayed placement of an "in-between" implant due to an acute infection, crown preparation of the adjacent teeth (#8 to #11) to support a four-unit bridge, and artificial pink planned from inception to drastically simplify the surgical procedures.

In particular, vertical augmentation was not attempted and filler materials were not used. A provisional bridge restoration that considered artificial pink from inception was placed to facilitate healing **(Figs 4 & 5)**.

To ensure optimal implant placement, a diagnostic wax-up was made and a vacuum form surgical guide was fabricated on top of it; this would direct the three-dimensional implant position for this technique. A black mark was made on the model to indicate the ideal "in-between" implant position **(Fig 6)**.

However, optimal implant placement success would also be dependent upon three other considerations: palatal screw axis, mesiodistal implant position in between the two missing teeth, and ideal implant depth. Implant depth is one of the most important factors affecting proper esthetics and hygiene with PHR. The key is fabricating a surgical guide that translates the pink prosthetic component to the mouth, indicating the apical position of the future interface between natural and artificial pink. When placed, the implant head should be deeper than this guideline.

Therefore, the surgical guide was fabricated with an apical/buccal extension above the teeth that would guide the implant depth during placement **(Fig 7)**. This extension was determined on the wax-up, taking into consideration the smile lip line reference.

Figure 1: Preoperative view of the unilateral defect at #9 and #10.

Figure 2: Significant bone and soft tissue defects in the interproximal and buccal areas were visible radiographically.

Figure 3: The sockets immediately after extraction; an acute infection necessitated delayed implant placement.

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Figure 4: The provisional bridge in the mouth after three months of healing.

Figure 5: The bridge after five months of healing.

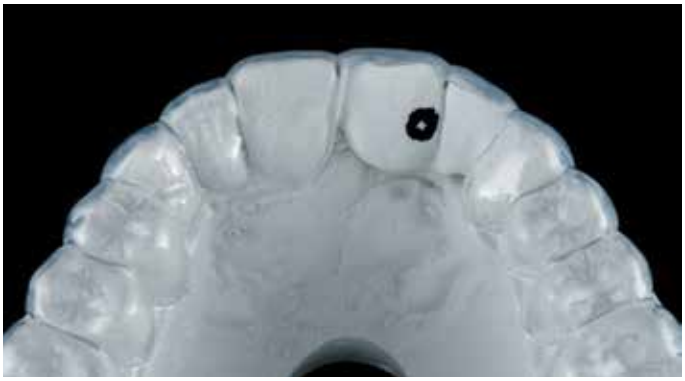

Figure 6: The black mark on the wax-up indicates the ideal "in-between" implant position for the vacuum form surgical guide.

Figure 7: Intraoral view of the surgical guide that would direct the implant position and depth for this technique. Note the apical/buccal extension above the teeth that would guide the implant depth.

During surgery, the 4.3 x 11.5 mm implant was placed deeper than it typically would be for a conventional implant restoration **(Fig 8)**. Following the surgical guide, some bone was removed from the ridge to flatten it and position the transitional interface between natural and artificial gingiva into a less critical esthetic area. Because the adjacent teeth already supported a provisional restoration, loading was delayed during the healing period.

However, after implant placement, the provisional was modified to improve esthetics and verify the final restoration design. This also provided the patient with a good opportunity to better understand the esthetic possibilities **(Fig 9)**. For example, the cemented provisional featured a large ridge lap, which would need to be removed in the final restoration, ideally by conditioning the soft tissue for a pink restoration **(Fig 10)**. Conditioning also could be achieved during provisionalization by connecting the provisional to the implant.

After healing, an ample amount of keratinized soft tissue was present around the site **(Fig 11)** and the implant was in the proper mesiodistal position, with equal distance to the adjacent teeth on both sides **(Fig 12)**. Flossing had been easily accomplished below the pink prosthetic portion of the provisional **(Fig 13)**, and its final esthetic outcome was approved by the patient **(Fig 14)**.

When fabricating the final screw retained metal-ceramic bridge, the goal was to focus on the white esthetics (i.e., tooth restorations) and, when approved, the bridge would be glazed and screwed in. Therefore, the artificial pink portion was initially in pink ceramics only and was not a perfect match in terms of shape, color, or texture **(Fig 15)**. To enhance esthetics, pink composite would be added and adapted to the new emergence profile created by the pink ceramics during a second appointment after complete soft tissue healing.

During that second appointment, the first step in preparing the pink ceramic for overlayering with pink composite was trimming the overcontoured areas to create space for a thin layer of pink composite **(Fig 16)**. The bridge was removed and, in preparation for bonding, small holes were made in the pink ceramics to increase retention of the pink composite **(Fig 17)**. The preparation process also included mechanical retention, acid etching, and application of a silane coupling agent and a bonding agent, after which the first layer of pink flowable composite was applied and light-cured. Subsequent layers, as needed, were also applied and light-cured **(Fig 18)**.

After the artificial pink portion was complete, the bridge was polished, seated back onto the implant, and torqued into place **(Fig 19)**. At the one-year and three-year follow-up visits **(Figs 20-25)**, the bridge and artificial pink demonstrated good esthetic stability, and optimal gingival health and bone stability surrounding the implant were also maintained.

Figure 8: After implant placement and according to the surgical guide, some bone was removed from the ridge to flatten it and position the transitional interface between natural and artificial gingiva into a less critical esthetic area.

Figure 9: After implant placement, the provisional was modified to improve esthetics and verify the final design.

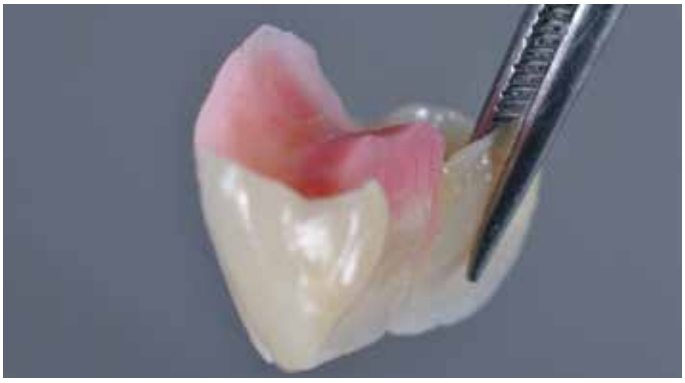

Figure 10: The cemented provisional featured a large ridge lap that would not be present in the final restoration.

Figure 11: Post healing view showing an ample amount of keratinized soft tissue around the site.

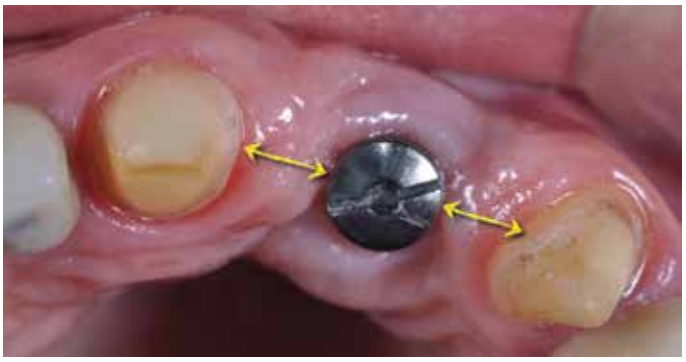

Figure 12: The implant is in the proper mesiodistal position, with equal distance to the adjacent teeth on both sides.

Figure 13: The ability to easily floss below the pink prosthetic portion of the provisional was checked.

Figure 14: The provisional restoration's final patient-approved esthetic outcome.

Figure 15: The final screw retained metal-ceramic bridge positioned into place, with the ceramics-only artificial pink portion.

Figure 16: Overcontoured areas of pink ceramic were trimmed to create space for a thin layer of pink composite.

Figure 17: The bridge after preparation for bonding/layering the pink composite.

Figure 18: The bridge after layering the pink composite.

Figure 19: The bridge after final polishing and final torque. (Surgical work by Francis Coachman, DDS, restorative and ceramics work by Christian Coachman, CDT, DDS)

Figure 20: One-year postoperative view showing good esthetic stability of the bridge and artificial pink.

Figure 21: Optimal tissue health and gingival condition after unscrewing the bridge at the one-year follow-up visit.

Figure 22: Palatal view of the bridge restoration after rescrewing and filling the access hole.

Figure 23: The bridge at the three-year follow-up visit.

Figure 24: At the three-year visit, the healthy gingival condition was noted immediately following bridge removal.

Figure 25: A three-year postoperative radiograph reveals good bone stability surrounding the implant.

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Case 2: The "In-Between" Implant Concept for Bilateral Defects

This patient presented with a large bilateral defect at teeth #8 and #9 after several unsuccessful periodontal and surgical treatments **(Fig 26)**. The hopeless nature of the teeth, as observed radiographically **(Fig 27)**, indicated the need for extraction of both teeth and treatment planning for implant placement. However, the limited space available for placing two implants, in addition to the converging axis toward the apex of the laterals, required consideration in this particular case. Therefore, two implant placement options were considered. The first option considered was placing the implant at either side (i.e., either the #8 or #9 site) **(Figs 28a & 28b)**. Another option was placing the implant at the "in-between" site **(Fig 29)**.

Ultimately, an "in-between" implant was placed to support a two-unit PHR, with the access channel positioned in the connector area **(Fig 30)**. The final restoration integrated well with the natural gingival architecture and surrounding teeth **(Fig 31)**, and the ideal "in-between" implant position was confirmed radiographically **(Fig 32)**.

Figure 26: Close-up preoperative intraoral view of the bilateral defect at #8 and #9.

Figure 27: Radiograph revealing the hopeless nature of #8 and #9, as well as the limited space available for placing two implants.

Figures 28a and 28b: One treatment option was placing an implant at either side (i.e., either the #8 or #9 site).

Figure 29: Another option was placing the implant at the "in-between" site.

Figure 30: Palatal (showing access channel) and facial views of the fabricated PHR.

Figure 31: Intraoral view of the final "in-between" implant and PHR. (Clinical work by Eric Van Dooren, DDS; ceramic work by Murilo Calgaro)

Figure 32: The ideal "in-between" implant position was confirmed radiographically.

Summary

Similar to the first two articles in this three-part series, this final article has presented a strategy for planning from inception partial maxillary anterior reconstructions using the "in-between" implant approach and PHR technique. Clinicians should consider the challenges of unilateral and bilateral defects on a case-by-case basis to best determine the advantages in time, cost, simplicity, and esthetics of proposed options for their particular patient's optimal benefit.

The "in-between" implant placement is a logical choice when two adjacent teeth are missing or will be extracted and, in between them, are missing papilla or a major soft and/or hard tissue defect that, for whatever reason, the team understands will not be completely resolved with surgical interventions. Additionally, if the patient has high esthetic demands and the pink defect will not allow the patient to smile confidently, then the "in-between" implant position with in-between artificial papilla and pink tissue represents an interesting solution for achieving ideal esthetics; improving prosthetic design for greater functional, biological, and esthetic benefits; and simplifying surgical procedures for greater treatment predictability and patient comfort and convenience.

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