

# Minimally Invasive Reconstruction in Implant Therapy: The Prosthetic Gingival Restoration

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In spite of the recent developments in periodontal and peri-implant surgical regenerative procedures, completely and predictably reestablishing the hard and soft tissue contours is still a challenge in cases with three-dimensional (3D) ridge deficiencies (Figs 1 and 2).

This article presents a reliable and consistent alternative to prosthetically restore cases with an uncertain surgical outcome or for those patients who do not

want to undergo regenerative surgical procedures (Figs 3 to 14). The innovative hybrid prosthetic gingival restoration (Figs 6 to 9) makes it possible to predictably achieve an excellent match between the prosthetic and natural gingiva. Understanding the indications and procedures involved with this technique requires a paradigm shift for the whole interdisciplinary team, but with considerable benefits to the patient.

Surgical procedures to reestablish the 3D architecture of hard and soft tissue ridge deformities have been developed and performed successfully throughout the last 15 years. In some cases, however, even after several state-of-the-art regenerative procedures such as bone grafting, soft tissue grafting, and orthodontic relocation, the results are still unpredictable, with compromised esthetic and functional results.<sup>1-7</sup>

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**Figs 1 and 2** Preoperative situation. The maxillary right lateral incisor and canine are missing, with extensive soft and hard tissue deficiencies. The right central incisor and first premolar will be extracted due to lack of interdental bone support and a peri-apical lesion.



**Fig 3** Try-in of the diagnostic wax-up, which will guide the 3D implant placement and the design of the final restoration.

**Fig 4** Healing after immediate implant placement.

**Fig 5** Ceramic try-in.



**Figs 6 and 7** The gingival part of the restoration, made of pink ceramic, is only a background that will be overlaid with pink composite resin.



**Figs 8 and 9** The restoration after the addition of the direct pink composite resin.



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**Figs 10 to 13** Final outcome with excellent integration of the restoration.

**Figs 14a and 14b** One-year postoperative radiographs showing acceptable bone levels around the dental implants (Nobel Active RP, Nobel Biocare, Göteborg, Sweden).



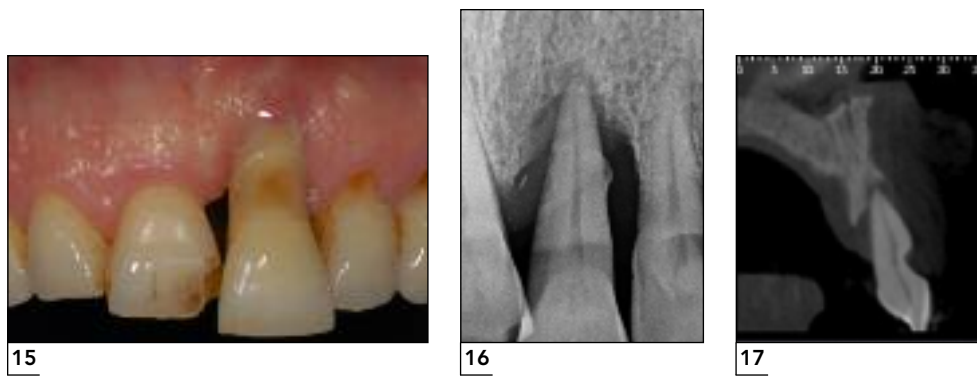
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The biggest challenge in alveolar ridge augmentation is the vertical aspect of the defect (Figs 15 to 21), including papillae and gingival margin levels, which are the most esthetically important areas of the gingiva. Tjan et al<sup>8</sup> showed that approximately 80% of the population display part of their gingiva when smiling, which means that the vast majority of

patients requiring tissue reconstruction will expose their gingival and ridge deficiencies. This information, in addition to the fact that patients are becoming more and more esthetically demanding, creates an explosive combination, since all available surgical procedures are often insufficient to reestablish ideal esthetics.



**Figs 15 to 17** Preoperative situation with extensive circumferential bone loss. Note the bone loss on the mesial aspect of the right central and left lateral incisors. The size, location, and shape of the defect would lead to very low predictability with conventional restorations.



**Fig 18** Ridge deficiency analysis. The dotted lines indicate the preoperative bone level (white), soft tissue (pink), and crown situation (yellow).

**Fig 19** Solid lines indicate the ideal position of the bone, soft tissue, and crown.

**Fig 20** The red area indicates the amount of bone that should be regenerated to support ideal soft tissue esthetics

**Fig 21** The red arrow shows the vertical distance between the preoperative situation and the ideal situation. This vertical gain, which is important for the final esthetic result, is the most challenging and unpredictable surgical modality.

The prosthetic gingival restoration in implant therapy can be an esthetic and functional alternative for reconstructing ridge deformities.<sup>2,9-18</sup> When designed from the outset—rather than being used as a last resort—it can dictate all adjunctive procedures necessary to achieve superior results.<sup>2,19</sup>

### TREATMENT PLANNING

When properly indicated, the prosthetic gingival restoration can predictably reestablish the esthetics of the missing soft tissue, reproducing the shape, color, and texture of the patient’s natural gingival.<sup>11-14,16,20-22</sup>

Teamwork and an interdisciplinary treatment plan are paramount to the diagnosis, execution, and long-term success of this restoration. After identifying the patient’s needs and expectations, the implantologist, periodontist, prosthodontist, and dental technician must recognize all obstacles to attaining the ideal pink and white esthetic results, and should discuss the technical and biologic limitations of each specialist’s role. All diagnostic data must be clearly communicated to the patient. Because many of these patients have already undergone unsuccessful regenerative procedures, they should be aware of the possibility of a compromised final outcome.

The prosthetic gingival restoration is a consistent alternative to restore the patient’s dentogingival complex.



**Fig 22** Diagnostic wax-up showing the amount of missing soft tissue and the ideal tooth shape. Managing the space was challenging because of the mesiodistal distance, which was smaller for the left central incisor than for the right central incisor. To solve this problem, the future crown was planned to maintain the buccal position as in the preoperative situation.



**Figs 23 and 24** Surgical guide. The two black lines on the stent show the cemento-enamel junction and the apical limit of the pink wax. The second line will be the depth guide for implant placement. The coronal part of the implant body should be located apically of this second surgical stent line and must allow for palatal screw access.



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#### Advantages:

- Improves the predictability of pink and white esthetic restorations.
- Reduces the need for and complexity of technique-sensitive surgical procedures.
- Is not dependent on the patient's previous treatments and restorations. **[Au: Correct?]**
- Improves intraoral comfort and air sealing during speech because of the smooth, uniform, and cleansable interface of the prosthetic gingiva with the remaining tissues.<sup>17,23</sup>
- Simplifies technical and clinical procedures, thus decreasing cost and time.
- Makes it possible to compensate for inadequate maxillomandibular relationships.<sup>21</sup>

#### Disadvantages:

- Requires proper patient education during treatment planning; otherwise, the patient may get frustrated when comparing the prosthetic gingival restoration to a removable partial denture.
- Requires an individualized maintenance program to ensure long-term success and patient discipline to accomplish rigorous hygiene procedures. This disadvantage can be minimized when the implants, grafts,

tissue conditioning, and restoration design are planned specifically for this technique.

## IMPLANT PLACEMENT: DENTOGINGIVAL DIAGNOSTIC WAX-UP

The dentogingival diagnostic wax-up (Fig 22) will produce an ideal esthetic restoration and will be the ultimate guide for the surgical (Figs 23 and 24), restorative, and laboratory procedures. The dental technician must have a deep understanding of the 3D tooth and implant positioning, gingival esthetics, and soft tissue management to design and execute an adequate dentogingival wax-up and restorations with harmony, balance, and continuity of form between the natural and prosthetic gingiva.<sup>14,17,20,22,24-26</sup>

During this stage, the dental team will analyze the 3D volume of tissue loss, implant position, and gingival interfaces, based on the Quadrant's Concept (Figs 25 to 29),<sup>19</sup> to minimize the visibility of this junction, restore the asymmetry of the gingival architecture, and replace papillae form.<sup>14,15,17,18,24,27</sup> This wax-up will generate a multifunctional guide with three important roles:



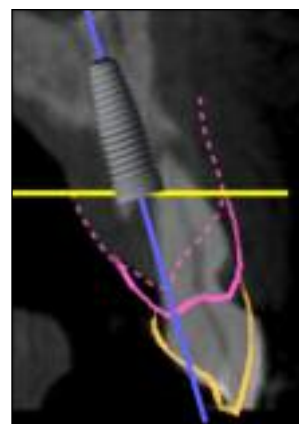
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**Fig 25** Implant positioning for gingival restoration. Computed tomography scan showing the ideal position of the crown and gingiva.

**Fig 26** The intersection of the pink line and dotted line (actual position of the gingiva) determines the horizontal line (yellow).

**Fig 27** The blue line determines the axial position of the implant, aiming for a screw-retained restoration.

**Fig 28** The intersection of the yellow and blue lines determines the ideal position of the implant for the pink restoration.

**Fig 29** Final design of the restoration.



**Figs 30 to 32** Immediate implant placement, palatally positioned to facilitate a screw-retained restoration. This is mandatory for a prosthetic gingival restoration. No attempt was made for vertical augmentation. A filler material (Bio-Oss, Geistlich, Zürich, Switzerland) was used to fill the gap between the implant and the buccal cortical plate to minimize horizontal resorption.

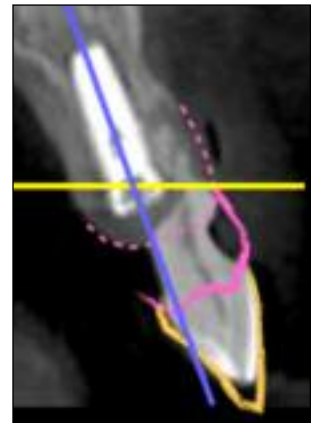
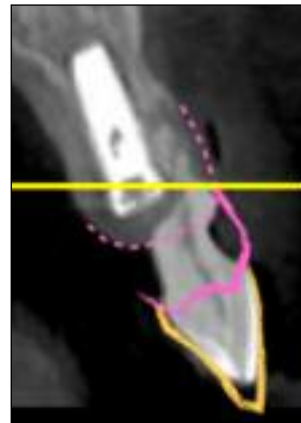
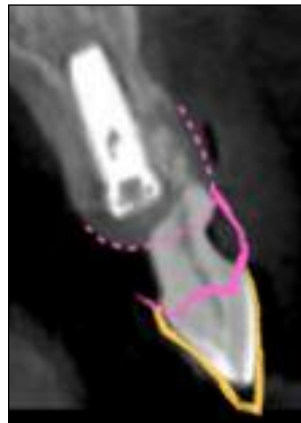
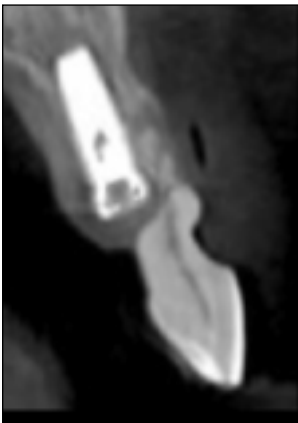
1. Radiographic guide that will allow the team to visualize the 3D volume of tissue loss<sup>28</sup> in the computed tomography images.
2. Surgical guide for implant placement in prosthetic gingival restoration cases, dictating the number, lo-

- cation, axis and, most importantly, the depth of the implants (Figs 30 to 39).
3. Surgical guide for hard and soft tissue recontouring to minimize the visibility of the junction between natural and prosthetic gingiva and to maximize comfort and hygiene procedures.



**Figs 33 and 34** The patient's natural tooth was used as an immediate provisional restoration, bonded to the adjacent teeth. Care was taken to give the ideal prosthetic support to the buccal gingival contour to minimize horizontal resorption.

**Fig 35** Radiograph showing the relationship between the implant and provisional. Note the apical placement of the implant in relation to the cemento-enamel junction of the adjacent teeth.



**Figs 36 to 39** Postoperative computed tomography scan. Note the apical and palatal implant placement coinciding exactly with the intersection of the yellow and blue lines, as planned on the preoperative scan.

**Fig 40** Customized ceramic shade tabs were produced for gingiva shade selection.

**Fig 41** Bisque-bake try-in to check the shade and shape of the crown. The shape of the pink ceramic and the interface between the prosthetic and natural gingiva should also be examined.



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## SOFT TISSUE CONDITIONING

The soft tissue design under the artificial gingiva is key for the biologic, functional, and esthetic success of this restoration and differs completely from that of a conventional implant restoration. The need for soft tissue conditioning should be planned on the wax-up, developed during the surgical and provisional phase, and refined when seating the final prosthesis, depend-

ing on the extension of the area to be conditioned (Figs 40 to 44).<sup>29</sup>

The alveolar ridge must be flat to generate an esthetic and cleansable interface between prosthetic and natural gingiva.<sup>17,23</sup> The lingual aspect of the prosthetic gingival restoration should resemble the natural palatal contours to achieve comfort during mastication and proper phonetics, avoid food entrapment, and promote air sealing.



**Figs 42 and 43** If too much pressure is observed at the interface, the area can be conditioned further to relieve the pressure.

**Fig 44** Shaping the submergence profile to control the pressure and design the interface between natural and artificial gingiva.



**Fig 45** Final shape, texture, and glaze.

**Fig 46 to 50** Metal-ceramic restoration after glazing and polishing.

## MATERIAL SELECTION

The materials available for the prosthetic gingiva are ceramics, composite resin, and acrylic resin. Each has its own advantages, disadvantages, and indications.

For cemented fixed partial restorations, ceramics are usually the material of choice to reproduce pink and white esthetics.<sup>11-18</sup> Due to the fact that ceramic is a delicate and challenging material to handle, with issues such as baking shrinkage, number of bakes, color matching, and moisture control, the final pink esthetic outcome may be compromised by an easily noticeable interface between the prosthetic and natural gingiva.

To overcome these limitations, a hybrid technique was developed to make the prosthetic gingiva

restoration more attractive and predictable.<sup>30</sup> The hybrid technique is defined by a screw-retained implant partial denture with the white esthetics and the background of the pink esthetics developed in ceramic and the final overlay of the pink contours developed in composite resin, directly in the mouth. Various kits of pink composite resins designed for this technique with different colors and stains allow for a customized restoration.

This hybrid technique offers some remarkable advantages (Figs 45 to 91):

- Preservation of the optical and physical properties of the porcelain by decreasing the number of ceramic bakes.



**Fig 51** First stage of the two-stage prosthetic gingiva technique. At the first insertion appointment, the patient's soft tissue is not in an ideal condition due to the procedures performed, such as numbing and reshaping. This makes matching the shape, color, and texture too difficult. The best solution is to install the restoration only with the ceramic part finished and then add the pink composite resin at a second appointment after soft tissue healing.



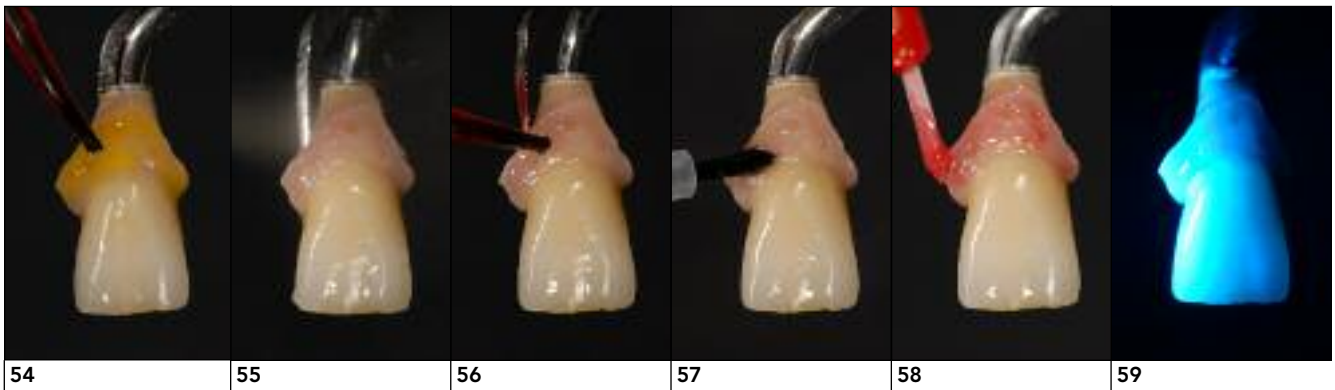
**Figs 52 to 59** Second stage. Preparing the restoration for the direct pink composite resin: (left to right) mechanical retention, sandblasting, acid etching, vapor steam, silane, adhesive, flowable composite, light curing.



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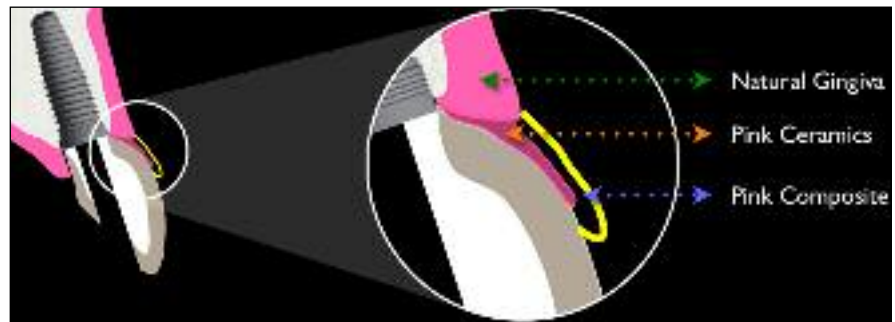
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**Fig 60** The restoration in place, ready for the direct composite buildup.



**Fig 61** Schematic illustration showing the amount of pink ceramic that should be placed and the space that should be left for the pink composite resin (yellow line).

- More predictability and greater control of pink esthetic factors such as shape, color, and texture.
- Possibility of repair, addition, recontouring, and uncomplicated maintenance, even after years of use, without having to refile the ceramic.



**Fig 62** The pink composite resin kit with different colors and translucencies (Anaxgum, Anaxdent, Stuttgart, Germany).



**Fig 63** The composite resin is added with a spatula, starting with a darker color as a background.



**Fig 64** Overlaying the composite resin with a lighter color.



**Fig 65** The margins are blended with a flat brush.



**Fig 66** With a fine-tipped probe, the grooves and the illusion of a gingival sulcus are created.



**Fig 67** Light curing is performed after each layer is placed.



**Figs 68 to 70** Light-curing stains can be used to customize the color.



**Fig 71** A brush is used to create the superficial texture.



**Fig 72** The finished composite resin buildup.



**Fig 73** The restoration is unscrewed so the pink composite resin can be finished chairside. Because of the interproximal extensions, the path of insertion should have two directions: first horizontal and then vertical. To accomplish this, the implant should have an external connection or a very short internal connection.



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**Fig 74** The thin edge of the pink composite should be trimmed, and the concavities underneath should be removed to improve resistance and cleansability.

**Fig 75** Ideal profile of the pink composite resin after the intraoral addition.

**Fig 76** When the restoration is removed from the mouth, it shows a thin extension on the edge of the pink composite resin that must be removed.

**Fig 77** Removing the edge with a diamond bur at a 45-degree angle.

**Fig 78** The edge is reduced but not removed completely. The concavity underneath is eliminated by adding an extra layer of composite resin that will create extra pressure on the soft tissue and remove the edge.



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**Fig 79** The concavities and thin edges are eliminated.



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**Fig 80** The restoration is placed back in the mouth.

**Fig 81** The goal at this stage is to blend the transition between the artificial and natural soft tissue. The removal of the pink composite resin edge will create a visible and unattractive interface that must be modified.

**Fig 82** The visible interface occurs mainly because of the difference in light reflection between the artificial and natural gingiva.

**Fig 83** A round diamond bur is used to match the profile of the artificial and natural gingiva.





**Fig 84** The unnatural angle between the artificial and natural gingiva is removed.

**Fig 85** The light reflection has a similar direction on the natural and artificial soft tissue, providing the illusion of continuity. This mimetic effect will improve even more with the addition of the saliva.



**Fig 86** The adhesive is applied to the areas where composite resin will be applied, such as undercuts and concavities.

**Fig 87** Adding pink composite resin to the undercuts and concavities may raise the complexity of the hygiene procedures.

**Figs 88 to 90** Final emergence profile after reshaping and adding composite resin chairside.



**Fig 91** During final polishing, care must be taken not to remove the gingiva-like texture.



## SEATING AND HYGIENE

During the seating process a transitory blenching may be observed. The intensity will vary depending on the extension of the tissue conditioning required, the design of the pontics, and the gingival biotype. The pressure between the natural and prosthetic gingiva should be checked with dental floss. Flossing in this

area should have the same intensity of pressure as exists with ideal interproximal contact between adjacent natural dentition. Excess pressure should be reduced by reshaping the soft tissue with diamond burs or a diode laser, or by recontouring the prosthetic gingiva with specific burs and wheels. The main goal is to create a comfortable, healthy, and cleansable interface while maintaining high esthetics.



**Figs 92 and 93** It is paramount to periodically probe the bone level on the adjacent teeth to check if the artificial gingiva flaps overlapping these teeth are compromising the surrounding tissues.



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**Figs 94 to 101** Hygiene procedures. The floss should go around the artificial gingiva on both sides and completely touch the interface between the natural and prosthetic gingiva.



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The hygiene and maintenance procedures should be carefully discussed with the patient. Follow-up appointments should be scheduled initially 3 months after insertion and then can be moved up to every 6 months to 1 year, depending on the patient's risk assessment.

Probing the bone level of the adjacent natural teeth is highly recommended before seating the pros-

thesis for further comparison during the follow-up appointments (Fig 92 and 93). During these sessions, the restoration should be removed to check the health of the soft tissue and to probe the adjacent teeth. If the situation of the soft tissues is not ideal, new hygiene education should be given, followed by reshaping of the prosthesis, if necessary, to allow ideal hygiene procedures (Figs 94 to 101).



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Fig 102 Final result.

Fig 103 Six-month postoperative view.



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When properly planned and executed, the hybrid prosthetic gingival restoration offers predictable functional and esthetic results (Figs 102 and 103).

Prosthetic, and technical procedures can be executed to maximize the biological, functional and esthetic results and surpass the patient's expectations.

## CONCLUSION

The prosthetic regeneration of pink esthetics is a reliable and consistent alternative to resolve cases with an uncertain surgical outcome or for patients who do not want to undergo regenerative surgical procedures. When this type of restoration is planned from the beginning of treatment, the appropriate surgical, restora-

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