AVOIDING COMMON FAILURES WITH SINGLE IMPLANTS IN THE ESTHETIC ZONE

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LEARNING OBJECTIVES

After reading this article, the participant should be able to:

1. Recognize that implant failure is multifactorial.
2. Identify the leading causes of implant failure.
3. Understand how to treatment plan adjacent missing teeth to achieve a predictable outcome.

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"A PROSTHETICALLY DRIVEN APPROACH INVOLVING REVERSE-ENGINEERED PLANNING AND GUIDED SURGERY WILL LEAD TO PROPER 3D IMPLANT PLACEMENT."

Abstract

Implant dentistry has evolved from having solely functional goals to striving for esthetic and long-term biologic stability. However, complications and failures can limit this stability. Therefore, to safeguard the implant's integrity, clinicians must diagnose the complication's cause accurately and treat it efficiently. This article discusses the most common complications with dental implants in the esthetic zone and helps clinicians to identify the possible risks and appropriate treatment options.

Key Words: implant failures, esthetic zone, implant position, phenotype, implant timing

Introduction

Implant failure involves the clinical and biological alteration of stability, leading to infection, pain, and bone loss, which may ultimately end in integration loss.[1] Implant failure is multifactorial. Patient health, age, habits, quantity and quality of hard and soft tissues, surface treatment, three-dimensional (3D) position, and the prosthesis itself all may lead to failure, which can occur at any time. Early failure can occur before the final restoration is delivered, and delayed failure can occur one to three years after delivery.[2] Currently, the criteria for success in implant therapy include functional, biological, and esthetic parameters; esthetic implant complications occur in approximately 10% of cases over five years.[3,4] Complications associated with the final restoration's appearance are easier to treat than those that are implant-related (e.g., malpositioned implants). However, soft tissue complications (e.g., gingival recession, gingival asymmetry, papilla collapse, and grayish discolorations of the soft tissues) are the hardest to resolve. To reduce the incidence of complications when treating implant patients, clinicians must have a systematic workflow that includes appropriate implant selection, proper placement and timing, therapy for adjacent edentulous sites, tissue management, and prosthetic design.[5]

Workflow

Implant Position and Selection

A prosthetically driven approach involving reverse-engineered planning and guided surgery will lead to proper 3D implant placement.[6,7] Inadequate buccolingual implant position is the most relevant factor leading to facial gingival recession **(Fig 1)**.[5] Buccolingually, the implant should be placed 3 mm palatal to the future restoration's facial aspect to protect the buccal plate. Implants should also be placed 1.5 mm away from neighboring teeth, and the implant platform should be placed 3 to 4 mm apical to the restorative zenith point of the future restoration **(Fig 2)**.[8] The axial inclination should allow for a screw-retained restoration **(Figs 3-11)**. Implant size is also critical, and wide implants should be avoided in the anterior zone to respect the safety zones. Additionally, narrower connections with platform-switch designs are associated with peri-implant bone stability.[9]

Figure 1: Facially placed implant with a superficial platform leading to a recession.

TiPS

"IN CASES WITH TWO ADJACENT MISSING TEETH, PLACING ONE IMPLANT AND A CANTILEVERED PROSTHESIS ENABLES A MORE PREDICTABLE OUTCOME THAN ADJACENT IMPLANT-SUPPORTED CROWNS."

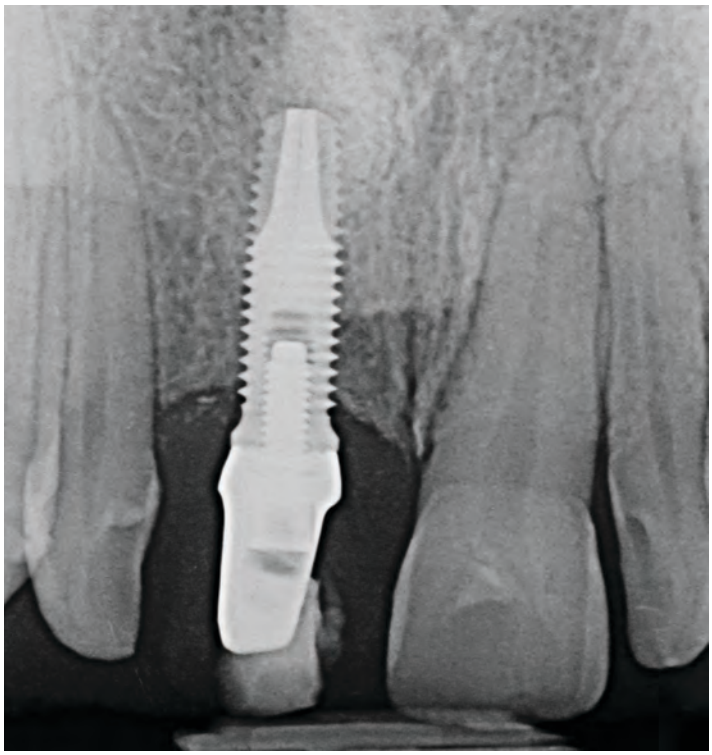

Figure 2: The implant presents a shallow position and exposed threads.

BEGINNER

- The correct 3D prosthetically driven position of the implant is the most relevant determinant influencing the esthetic result of the final restoration.
- Use minimally invasive procedures, avoiding vertical releasing incisions when possible; this may help to prevent future complications, reducing treatment time, cost, and morbidity.

INTERMEDIATE

- Provisionals are mandatory in the esthetic zone to properly shape the emergence profile of the future restoration.
- Adjacent implant restorations may be challenging and require careful space planning and execution to preserve the papilla volume.

ADVANCED

- Soft tissue management and grafting may prevent complications and are extremely helpful in treating esthetic complications.
- Severe esthetic complications may require extraction of the failing implant and even bone augmentation. A comprehensive treatment plan should be developed and evaluated, and the patient should be offered other possible predictable treatment options, such as a tooth-supported prosthesis.

Figure 3: The implant is unrestorable; explanting it is the best option to resolve the esthetic and biological problems.

Figure 4: A new implant immediately placed in the extraction site.

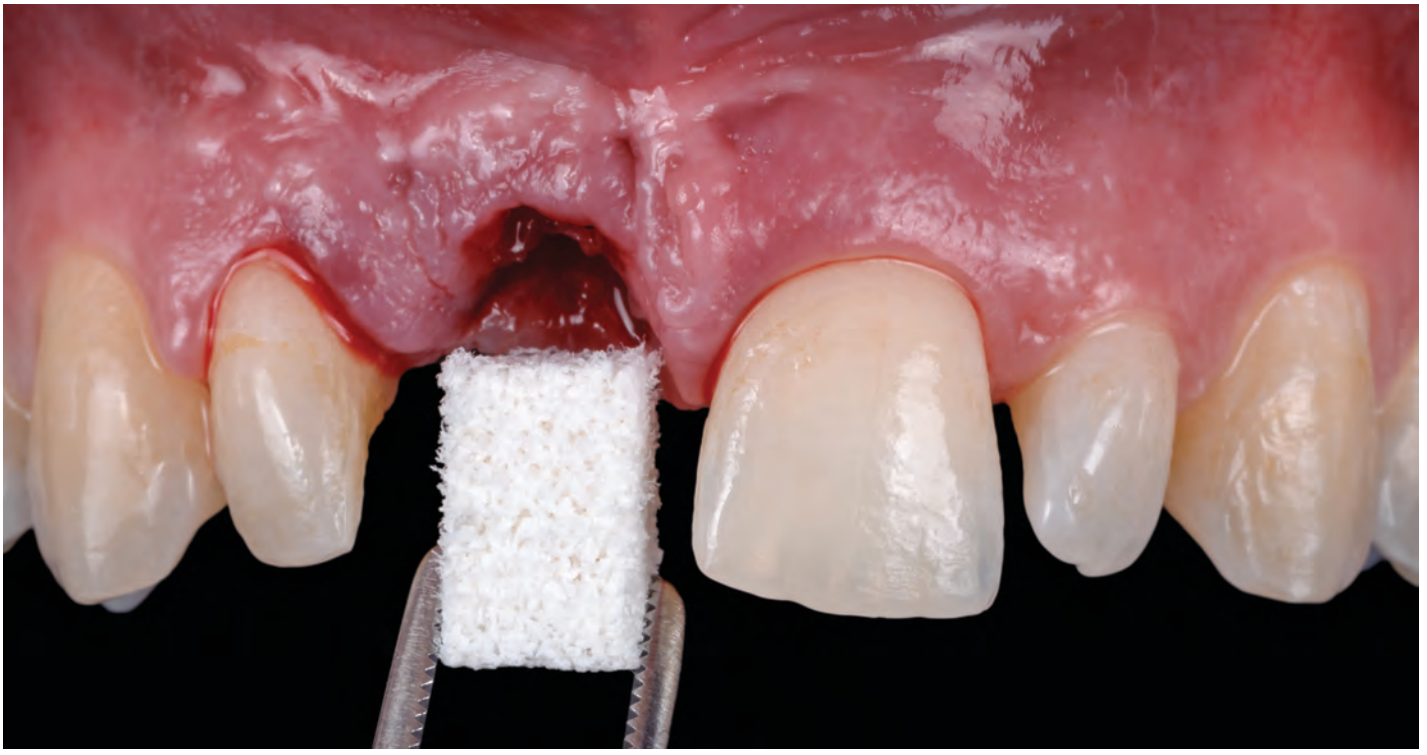

Figure 5: Socket preservation with a spongeous bone substitute at implant placement.

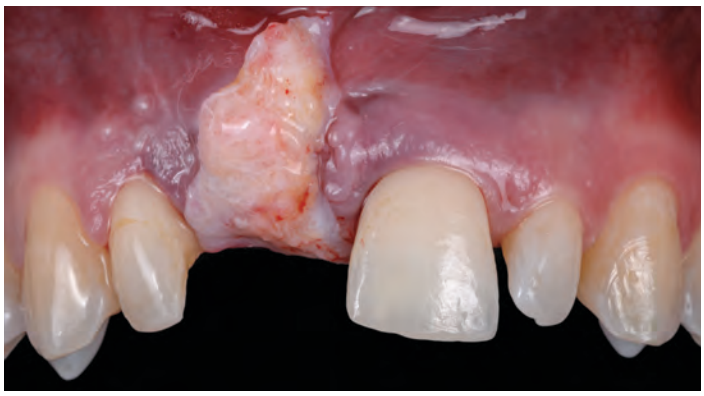

Figure 6: A connective tissue graft was used to cover the biomaterial and enhance the phenotype.

Figure 7: A provisional restoration delivered to condition the peri-implant soft tissues.

Figure 8: The implant-supported crown was combined with veneers in the anterior zone to restore the diastemas.

Figure 9: A ceramic abutment was used to facilitate the color balance between the crown and the veneers.

Figure 10: Veneers and micro veneers help to create harmony when peg-shaped teeth are present.

Figure 11: An implant-supported restoration placed on the maxillary right central incisor and veneers on all other teeth in the esthetic zone.

Figure 12: An anterior esthetic complication involving scars and a soft tissue defect after hard tissue reconstruction and implant placement in the anterior zone.

Timing of Implant Placement

Systematic reviews report that survival and esthetic results of immediate implants are similar to those of early and delayed approaches, but early complications with immediate implants are threefold.[10-12] However, one of the main advantages of immediate placement is that flapless approaches are beneficial to achieving an esthetic result in post-extraction sockets and healed ridges.[13]

Therapy for Adjacent Edentulous Sites

Extraction of several neighboring teeth leads to dimensional changes and flattened bone architecture. In these situations, the fewest number of implants and planning for implant-supported fixed prostheses is preferred over adjacent implant-supported crowns.[14] In cases with two adjacent missing teeth, placing one implant and a cantilevered prosthesis enables a more predictable outcome than adjacent implant-supported crowns.[15] If adjacent implants are needed, a 3- to 4-mm space between their platforms will promote interproximal bone stability, thereby preventing papilla collapse.[16] Also, the contact points of the restorations must be 5 mm or less from the bone crest to allow for full papilla fill.[16-18] If proximal deficiencies are present, tooth form should be modified from triangular to squared shapes, thus reducing the gingival embrasure sizes.[18,19]

Hard and Soft Tissue Evaluation and Management

Hard: Proper tissue evaluation and management are essential to help ensure that the soft tissues respond positively to the delivered restorations. The predictability of implant site enhancement through bone grafting before or during implant placement has increased due to greater knowledge of bone healing techniques and biomaterials available.[20] However, the predictability of implant site enhancement is related to the severity and anatomy of the bone defect. It is advisable to strive for less invasive techniques, and the potential risks and benefits must be discussed with the patient to create realistic treatment expectations.

"WHEN THE IMPLANT IS IN THE PROPER 3D POSITION, IT IS ADVISABLE TO UNDER CONTOUR THE DESIGN OF THE PROVISIONAL RESTORATION'S EMERGENCE PROFILE."

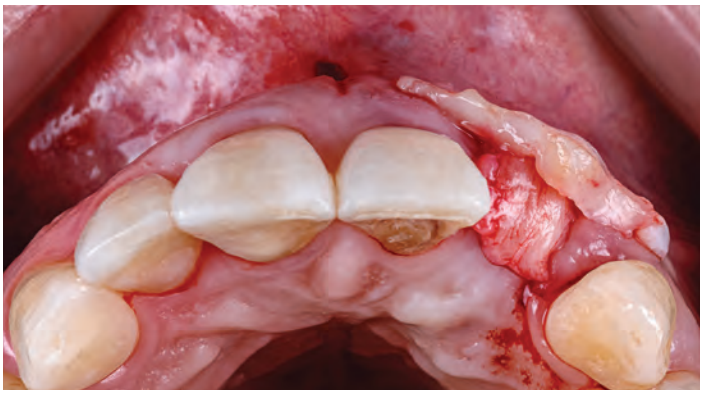

Figure 13: Two tunneled CTGs from the tuberosity were used to reconstruct the papilla volume.

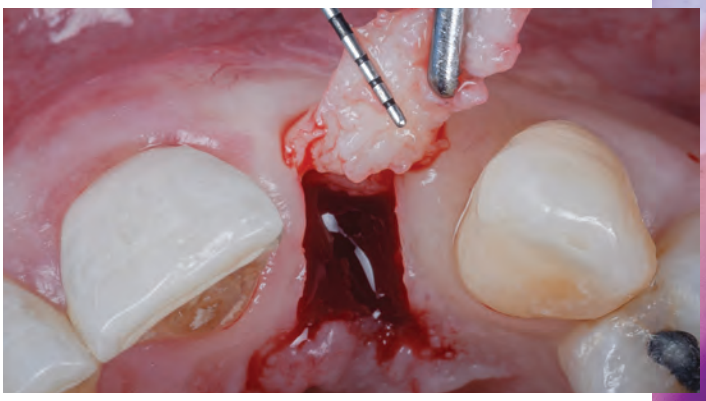

Figure 14: A roll-on CTG was performed during the second stage of surgery to further enhance the tissue volume.

Figure 15: Proper soft tissue conditioning with a provisional restoration helped to achieve a natural emergence profile for the final restoration.

Figure 16: Final restoration delivery.

Soft: Esthetic soft tissue complications must be treated according to their cause. Thick phenotypes are less susceptible to gingival recession or grayish discoloration than thin phenotypes.[21] Thick tissues (i.e., 3 mm or thicker) will prevent grayish discoloration and promote biological stability.[4] Connective tissue grafting (CTG) offers an effective approach to treating many of these complications. It is essential to select the proper soft tissue donor site and employ the appropriate technique. For example, avoid excessively thick grafts or leaving epithelium, which may cause epithelial cysts and/or pseudo pockets.[22]

The presence of a papilla is vital for an esthetic outcome; its size is related to the dimensions of the bone crest of the adjacent tooth **(Fig 12)**.[5,23] If the tooth's crest and papilla are deficient, orthodontic extrusion can help to enhance them.[18] However, if neighboring teeth are lost, the papilla dimensions will depend on the anatomy of the bone crest between them. Papilla reconstruction techniques have been described, but they lack predictability **(Figs 13-18)**.[24,25]

Tissue quality is another important consideration for achieving a biologically stable and esthetic result. A band of keratinized gingiva (KG) wider than 2 mm has been associated with greater tissue stability over time.[5] Vertical releasing incisions should be limited to the KG to prevent scarring during surgical procedures.[26] Lastly, gingival symmetry with neighboring teeth should be considered. Adjunct therapy (e.g., orthodontics, soft tissue grafting, crown lengthening, and restorative procedures) on adjacent teeth may help achieve a harmonious balance.[27]

Prosthetic Design

An adequate prosthetic design will promote successful results if all the peri-implant tissues are suitable. Proper implant position, material selection, restorative design, and enhancing thin phenotypes with CTG decrease the chances of esthetic problems.[28] Provisional restorations are essential in tissue conditioning to help emulate natural dentition.[29] This conditioning can be done progressively by changing the contours of the provisional restorations. When the implant is in the proper 3D position, it is advisable to under contour the design of the provisional restoration's emergence profile[30]; this guarantees enough tissue space to prevent a gingival recession or grayish discolorations. Clinicians also should strive for screw-retained designs or the use of angled screw channel abutments, as excess cement around restorations is detrimental to the peri-implant environment **(Figs 19-24)**.[31]

Discussion

Implant complications may result from improper treatment planning, the patient's biological response, or inadequate prosthetics. Preventive measures are necessary during implant placement. It is vital to pay close attention to the implant's buccolingual position and proximal relation to neighboring teeth.[5] If the interproximal bone is compromised, the soft tissues will collapse, causing black triangles.[32] A minimum of 3 mm inter-implant distance is necessary when adjacent implants are planned. However, if possible, a single implant with a cantilevered restoration should be considered.[33]

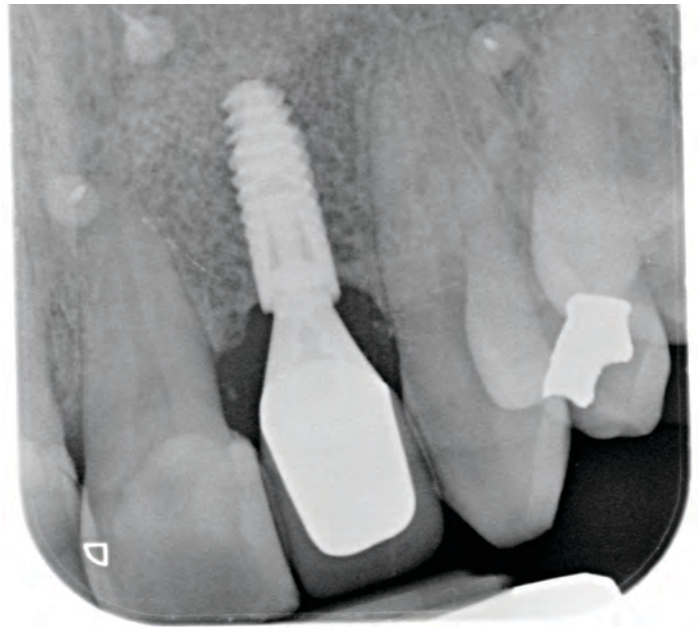

Figure 17: Radiographic image of a properly placed implant with an adequate abutment design and definitive restoration.

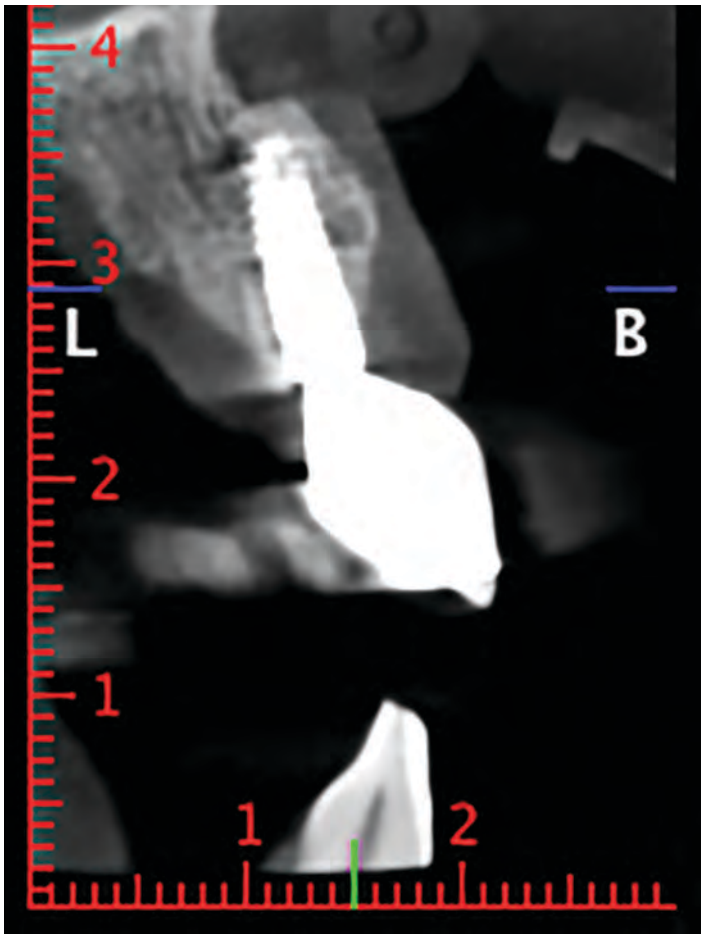

Figure 18: CBCT image showing the facial bone defect compensated with soft tissue.

Figure 19: An inadequate prosthodontic design with excess cement affects the long-term stability of the peri-implant environment.

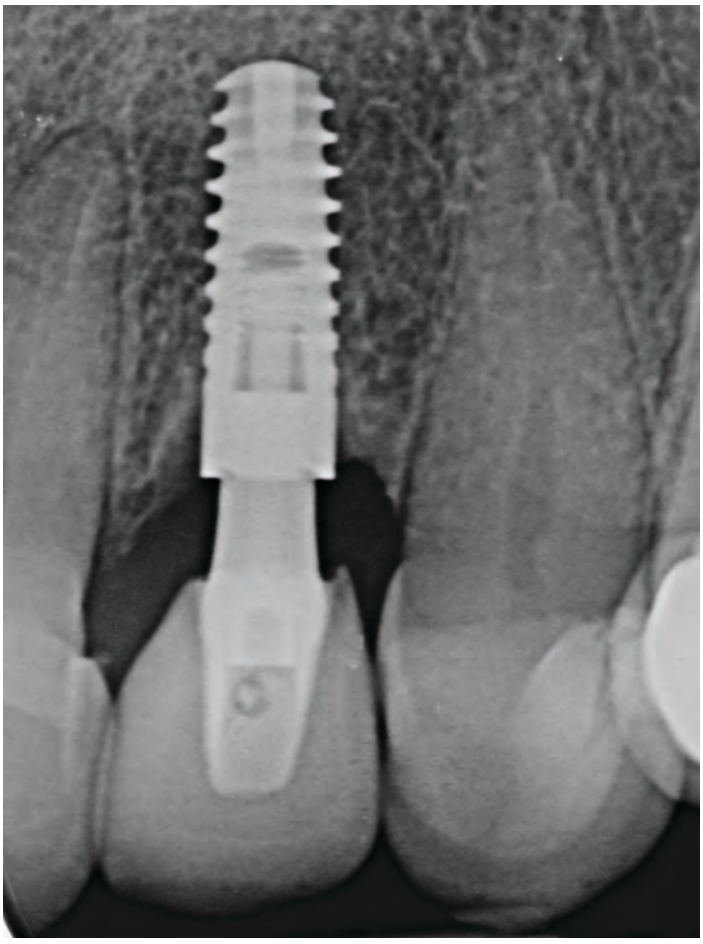

Figure 20: Radiograph revealing that the over contoured crown retained cement and caused tissue inflammation.

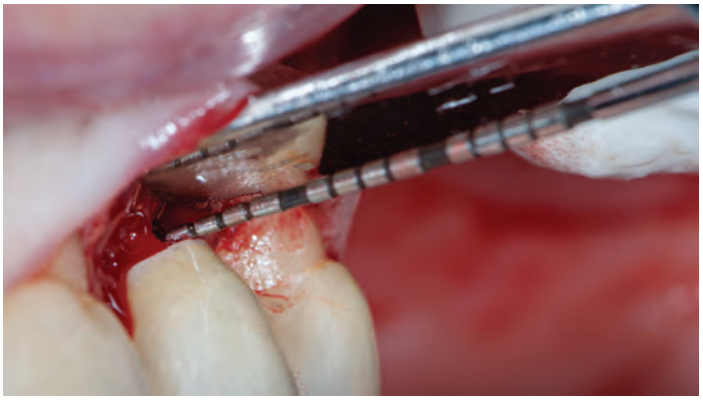

Figure 21: The micro flap was raised to remove the cement and recontour the restoration to reduce gingival inflammation.

Figure 22: The esthetic sequelae of the surgery were buccal and proximal soft tissue defects.

Figure 23: A tuberosity CTG was performed to enhance the facial and interproximal areas.

Figure 24: Resolution of the complication via prosthetic and periodontal enhancement.

To determine the root of the complication and resolve it, the existing restoration should be removed to evaluate the implant position.[34] If the complication is strictly prosthetic (the simplest situation), the solution would be to redesign the restorations following esthetic biologic contour principles.[30] If soft tissue or mild bone dehiscences are present, they may be treated with soft tissue grafting procedures alone.[35] More significant bone defects will require the use of resorbable membranes and biomaterials or mixed hard and soft tissue grafts.[36-39]

Therapy becomes more complex if the implant is not in the proper position. A facial axial inclination as large as 40 degrees can be corrected with a custom abutment and a CTG, but the implant may need to be removed if the inclination is greater than that.[40] For mild proximal defects, a CTG may be a solution for reconstructing the proximal papilla volume, but this is only partially predictable.[23,40] When the embrasure opening is severe and less than 1.5 mm of proximal bone is left, papilla reconstruction is impossible, but orthodontic extrusion of the adjacent teeth may help to solve the problem.[40-42]

Summary

Complications and failures can limit an implant's esthetics and long-term biologic stability. To safeguard the implant's integrity, clinicians must be proficient in diagnosing the cause and effectively treating the complications. The 3D implant position is the most critical factor leading to implant failures. Thin phenotypes may be increased with CTGs to maintain a long-term stable result. Papilla presence depends on the bone attachment to the neighboring tooth and the contact point position. However, to enhance the result, mucogingival techniques may boost tissue volume. Although dealing with complications may pose challenges in cases involving single or adjacent implants in the esthetic zone, when the restorative team—the surgeon, restorative dentist, and laboratory team—works collaboratively and adheres carefully to efficient and safe workflows, it is possible to ensure a higher likelihood of success.

"TO SAFEGUARD THE IMPLANT'S INTEGRITY, CLINICIANS MUST BE PROFICIENT IN DIAGNOSING THE CAUSE AND EFFECTIVELY TREATING THE COMPLICATIONS."

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