

Esthetic excellence in Implantology: The trinomial era

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Introduction

Esthetic advances resulting from the use of dental implants have been some of the major reasons why patients and dentists prefer treatments with implants.

Primarily designed and developed for safe anchorage of prostheses without esthetic concerns, this type of treatment gained larger acceptance when its purpose became the replacement of teeth in areas with great esthetic demands. Recent advances in implant and abutment designs

and appearance, as well as the improvement of new ceramic systems, have been fundamental factors in such acceptance. These factors have undoubtedly aggregated esthetic excellence to the treatments with implant-supported prostheses. Therefore, the aim of beautiful prosthetic crowns on adequately placed implants has become feasible and predictable in our daily clinical practice. As a result, the following question is raised: What is the main challenge in implant-supported prosthetic treatments? The answer seems to lie beyond the crown-implant pair.

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Never before in this half a century of osseointegrated implantology supported by scientific findings, so much importance has been assigned to the tissues surrounding the prosthesis¹. An implant-supported prosthesis may only achieve actual esthetic excellence when in consonance with the gingival tissue that surrounds it.

Tissue response has gained so much importance that it reached the status of “pink esthetics”, and the gingiva holds center stage in the triad implant-crown-gingival tissues. Therefore, clinicians should understand that esthetic excellence is now fundamentally defined by this triad, and not anymore by the sole fabrication of beautiful implant-retained ceramic crowns.

Since the importance of gingiva became clear to implantologists, much has been investigated about the safest and most efficient way to handle this tissue. Different approaches may be used to achieve a satisfactory gingival contour. For teaching purposes, they may be divided into those applicable to fresh or healed extraction sockets.

Techniques for gingival contour and emergence profile in implant-supported prostheses

1. Fresh extraction sockets

- 1.1. Extraction + implant placement + immediate provisional prosthesis.
- 1.2. Extraction + implant placement (no loading).
- 1.3. Extraction and contour preservation with provisional prosthesis.

2. Healed sockets

- 2.1. Successive changes of healing abutments, with progressively larger diameters.
- 2.2. Successive gingiva compressions by adding resin to the provisional crown.
- 2.3. Immediate technique for defining gingival contour and emergence profile (Immediate Gingival Conditioning, IGC).

1. Fresh extraction sockets

Item 1.1 should be emphasized because of its importance in terms of timing and opportunity for its performance, as well as the predictability of its results. The placement of an implant and provisional crown immediately after tooth extraction preserves gingival architecture, because the provisional crown supports and maintains gingival shape and contour, and ensures the definition of the margins of the soft tissue until its maturation is complete.¹ To preserve gingival contour and papillae, extraction should be performed with as little trauma as possible and without flap elevation or gingival detachment. This is the best and most predictable clinical procedure to preserve gingival architecture. Two techniques are used most frequently, and the choice is made depending on the presence or absence of the buccal bone plate, which may be assessed immediately after the extraction.

When the buccal bone plate is present, the implant may be placed and immediately followed by the provisional crown. The space between the implant and the socket wall may be filled by a clot, synthetic material, or autogenous bone shavings. If there is no bone plate, an Immediate Dentoalveolar Restoration (IDR)² technique should be used.

The absence or loss of the buccal bone plate is associated with length of time from root fracture, or fissure, to surgery. The longer the time interval, the greater the chances of developing inflammation or infection (fistulas, suppuration), which may destroy the underlying bone.

In the IDR technique, bone, gingiva, or both are removed from the tuberosity and implanted in the buccal region where there is no bone plate. In this technique, no incision should be made, nor should a mucogingival flap be elevated before extraction. Figure 1 shows the sequence of steps in this type of procedure.

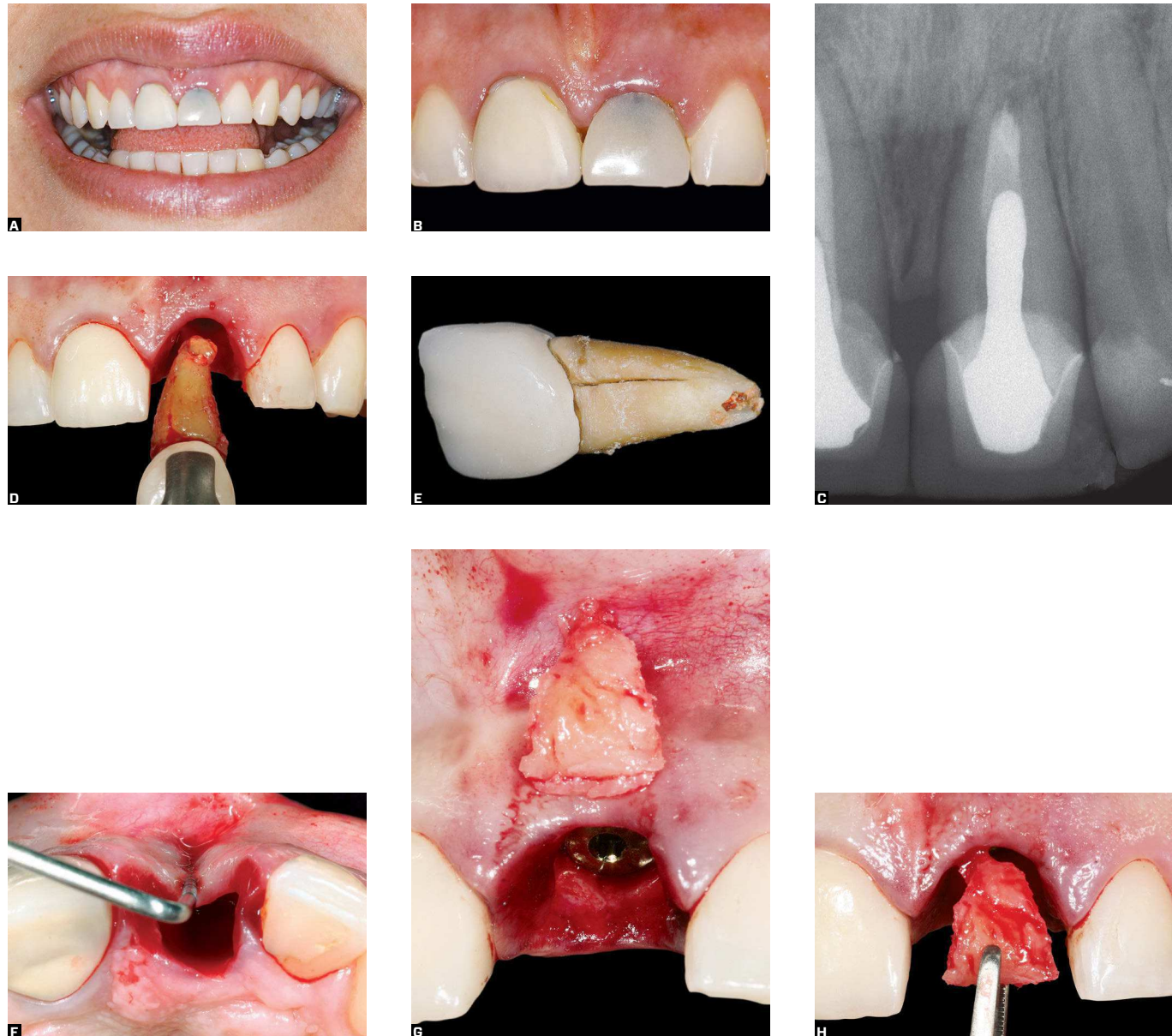


Figure 1 - **A)** View of gingival smile, which poses difficulties to achieving good esthetic results. Clinical probing (tooth 21) revealed root fracture. **B)** Figure **B** shows inflammation of marginal gingiva. Patient reported recurring release of crown and cast metal post. **C)** Radiograph of tooth 21 shows discrete apical lesion. **D)** Surgical stage of extraction: at this stage, the purpose is to limit trauma to surrounding tissues to a minimum. **E)** Extracted tooth, with longitudinal root fracture. **F)** Compression of gingiva and loss of buccal bone plate. **G, H)** Bone fragment in form of wedge removed from maxillary tuberosity during dimensional checking before grafting.

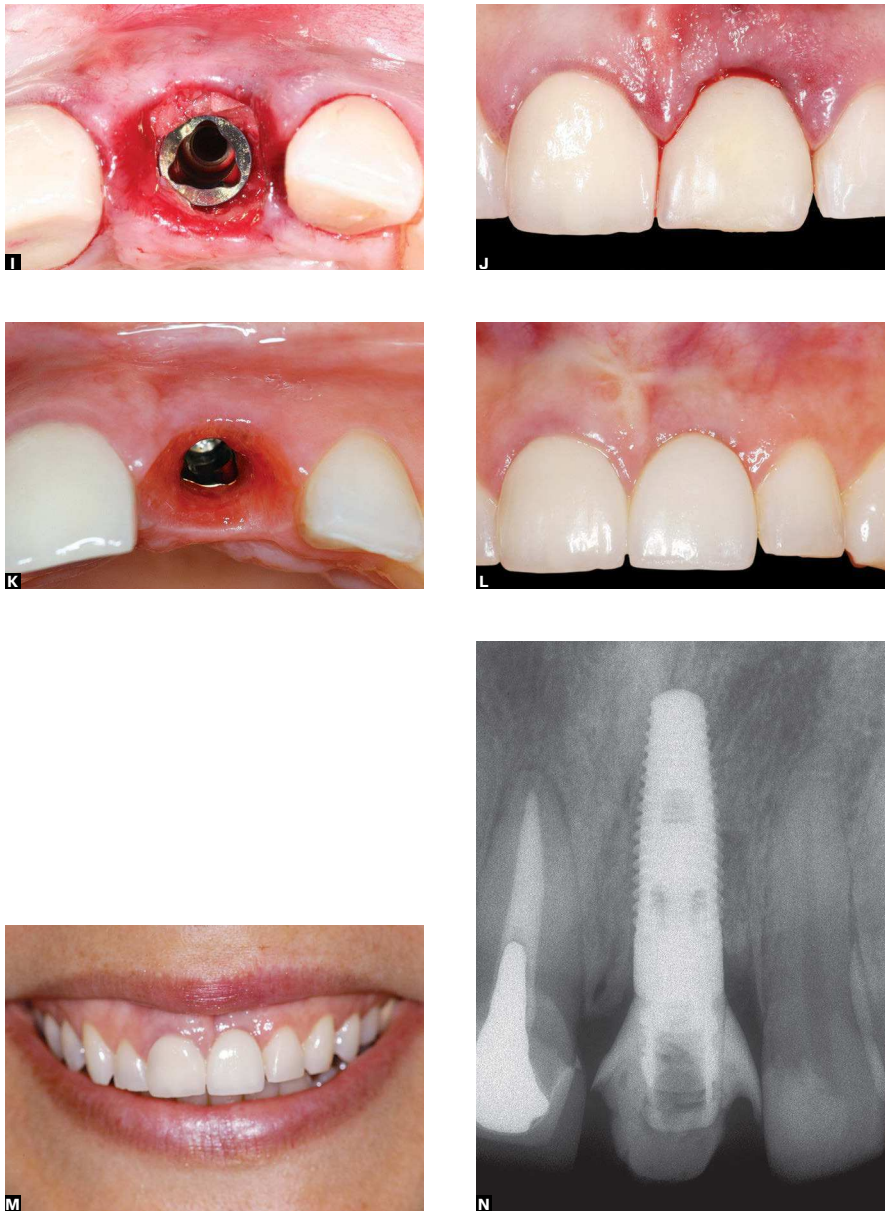


Figure 1 - **I)** Occlusal view shows autogenous graft in place between implant and buccal gingiva tissue. **J)** Provisional restoration screwed over implant. **K, L)** Clinical aspect 6 months after implant placement: tissues around crown have a favorable progression. **M)** Final smile with satisfactory transition between crown and gingiva. **N)** Radiograph after placement of prosthetic crown over implant (2 years follow-up).

The provisional crown may be directly screwed to the implant platform or cemented onto a provisional prosthetic abutment. The first one is the better option. For that purpose, the implant should be placed in a slightly lingual position, that is, at the expense of the palatal wall of the extraction socket.

In items 1.2 and 1.3, implants are not immediately loaded, but the same care should be taken during extraction (minimal trauma and no flap). A provisional crown supported by neighboring teeth should be kept in place until the socket heals (item 1.3), or as long as necessary for osseointegration (item 1.2). To preserve gingival contour, the cervical portion of the provisional crown should have the same shape and diameter of the cervical region of the extracted tooth root, and its apical portion should be ovoid and placed partially inside the surgical wound. In addition to preserving and redefining the natural contour of the gingiva, the ovoid shape, slightly adapted to the surgical socket, works as

a buffer and contributes to the stability of the blood clot or the filling material placed in the socket.

In 1.2 and 1.3, attention should be paid to maintaining and preserving gingival contour and the papillae, not only at second-stage surgery, but also during implant placement.³⁻⁶

It should be clear that an extraction, particularly in esthetic areas, should be planned as preparation for the immediate or future placement of an implant.

Even when immediate loading is not possible, gingival shape and contour should be preserved at the expense of provisional crowns supported by neighboring teeth. If such maneuvers are not made at this phase of the treatment, gingival repair will occur freely, and the edentulous ridge will invariably acquire a flat profile (plateau). There may be partial or total loss of the usual gingival contour, as well as loss of papillae characteristics, and the gingiva will have to be repositioned in the future to restore its original shape.



Figure 2 - A) Periapical radiograph of tooth 21, with cast metal post and metal-ceramic crown. **B)** Baseline clinical appearance.



Figure 2 - **C)** Tooth #21 root with fracture, which indicated its extraction. **D)** Temporary abutment over implant. The implant was placed during the appointment for tooth extraction. **E)** Provisional crown placed over temporary abutment. Palatal perforation ensures cement excess extravasation into supragingival area; which is particularly important in cases of implantation in fresh extraction socket, as cement excess may reach deeper peri-implant levels. **F)** Buccal view of crown with adequate gingival support, as well as absence of occlusal contacts in protrusive excursion of mandible. **G)** End of osseointegration phase, with provisional crown and full preservation of usual gingiva contour. **H)** Zirconium abutment for definitive restoration. Concave gingival shape in cervical portion. **I)** Zirconium abutment attached to implant. **J)** Ceramic crown and gingival contour in concave arch shape. **K)** Periapical radiograph shows concave profile of abutment.

2. Healed extraction sockets

Implants in healed sockets demand a different approach from the one used for fresh extraction sockets. In this case, gingival management is essential to reposition the soft tissue according to its original contour. Combined with accurate implant positioning and adequate selection of prosthetic components, these maneuvers play an important role in esthetic success.

To achieve the desired gingival contour, noninvasive techniques, such as the ones described in items 2.1 and 2.2, or minimally invasive techniques, such as the one in item 2.3, should be used.

2.1. Successive changes of healing abutments with progressively larger diameters

This has become a fairly common technique since attention was first paid to esthetics in osseointegration. The successive changes of healing abutments with progressively larger diameters gradually increase the intra-gingival space, though in a circular form. The shape of the gingival contour should be additionally defined using provisional restorations, often following a sequence as the one presented in the item 2.2.

As an alternative for abutments with successively larger diameters, abutments with a fixed diameter, but a circular cross-section, may be used, with more retention grooves in its body and the addition of acrylic resin. Additions may be repeated every week until the desired gingival separation is achieved (Fig 3). These abutments with resin additions should only be placed on implants after polymerization, contour adaptation and polishing.

2.2. Successive gingival compression using resin additions to the provisional crown

This technique has become a classical step to achieve the desired gingival contour when implants are placed in healed sockets.⁷

Acrylic or composite resin is added to the provisional crown causing gingival compression, which should not produce marked gingival ischemia. Later, compression is reduced, and gingival remodeling is guided by the new contour of the provisional crown. This maneuver may be repeated every week until the ideal gingival contour is achieved. Only after gingival contour has stabilized, impressions of the implant, prosthetic abutment, and gingival contour and profile should be taken (Figs 4 and 5).

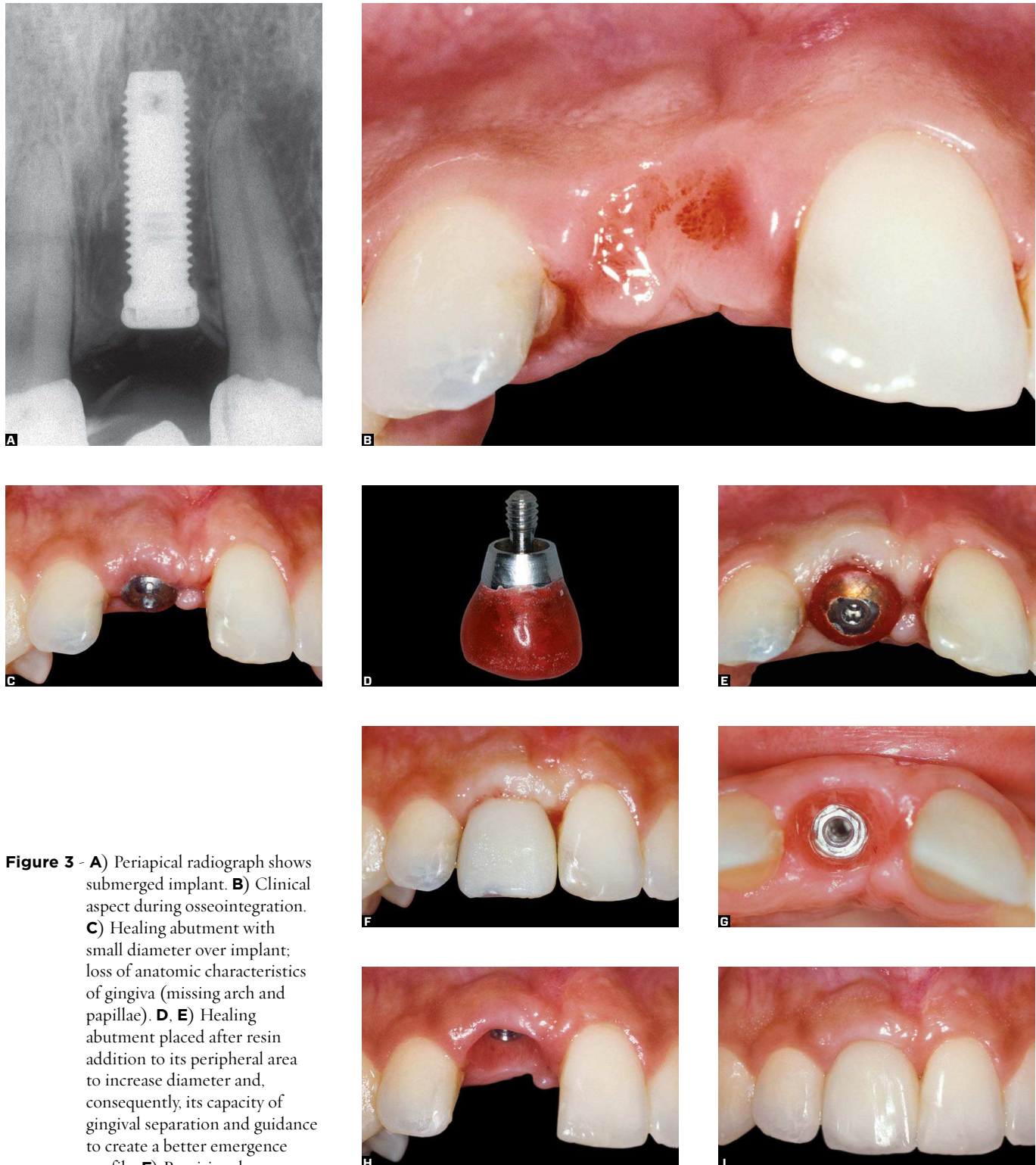


Figure 3 - **A)** Periapical radiograph shows submerged implant. **B)** Clinical aspect during osseointegration. **C)** Healing abutment with small diameter over implant; loss of anatomic characteristics of gingiva (missing arch and papillae). **D, E)** Healing abutment placed after resin addition to its peripheral area to increase diameter and, consequently, its capacity of gingival separation and guidance to create a better emergence profile. **F)** Provisional crown replacing healing abutment to refine and complete gingival guidance for esthetic results. **G)** Peri-implant tissue after final recontouring. **H)** Buccal view shows adequate gingival contour and papillae. **I)** Ceramic crown after finishing.

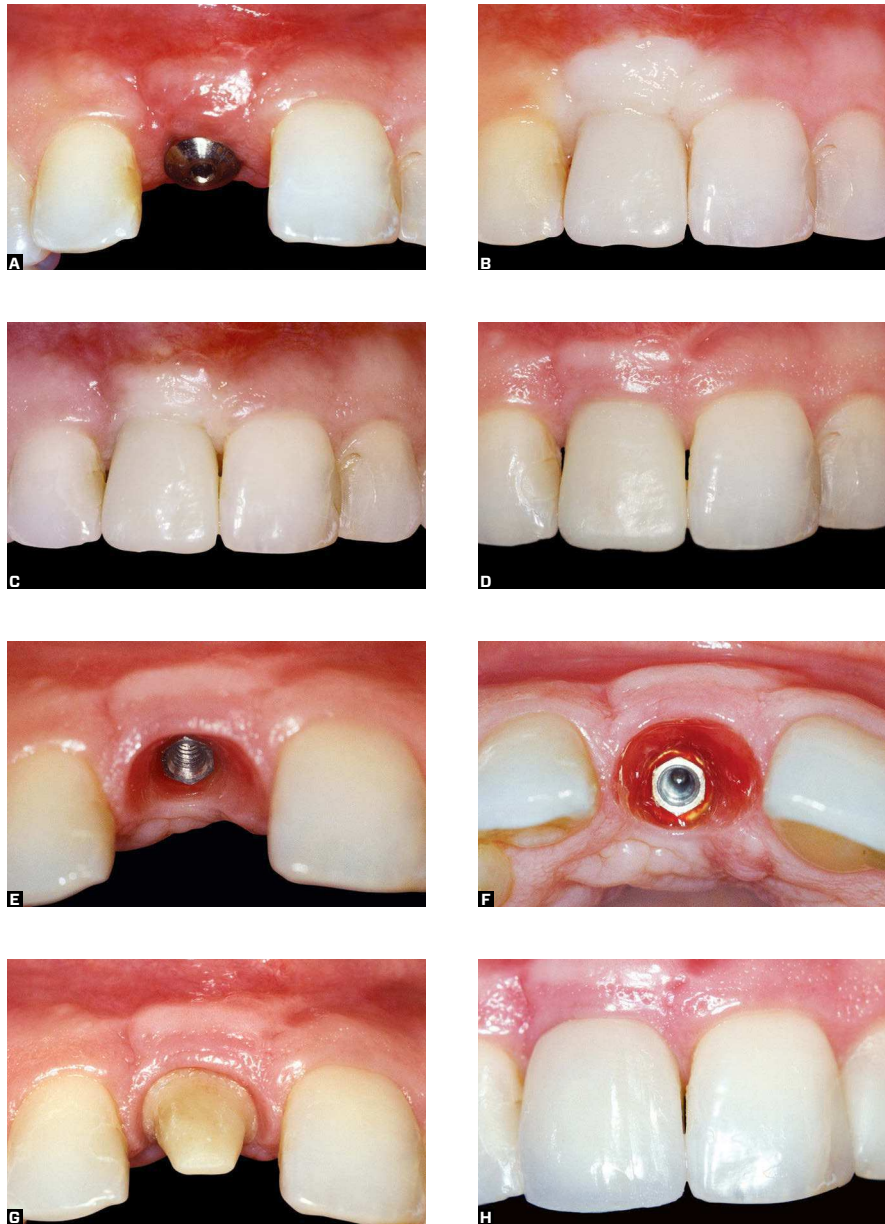


Figure 4 - **A)** Gingival tissue after placement of healing abutment. **B)** Beginning of tissue compression (ischemia) to guide gingiva and achieve esthetic results. **C)** Second phase of gingival guiding and new tissue compression at about one week after first compression. **D)** Final recontouring result. **E, F)** Positive aspect of peri-implant soft tissue: adequate emergence profile and gingival contour, and clear papillae margins. **G)** Prosthetic alumina abutment. **H)** Finished ceramic crown shows excellent transition from surrounding gingiva.

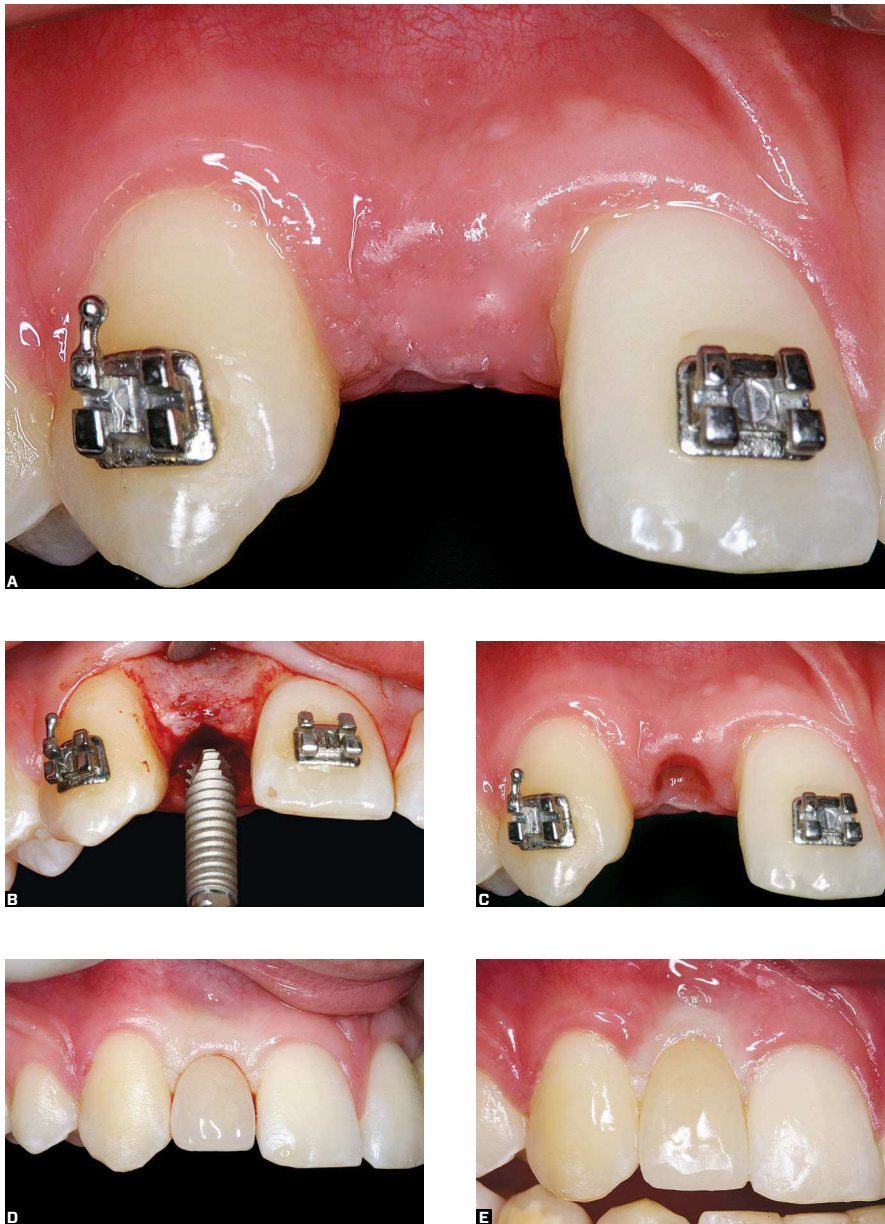


Figure 5 - **A)** Tooth #12 agenesis. **B)** Surgery to place an implant in tooth #12 region. **C)** Clinical aspect of gingiva after removal of healing abutment; implant osseointegration was complete. Although healthy, case completion will demand gingival recontouring to optimize esthetic results. **D)** Beginning of tissue compression (ischemia) to guide gingiva and achieve esthetic results. **E)** Second session of gingival guiding. Successive compressions favor reestablishment of regular gingival contour.

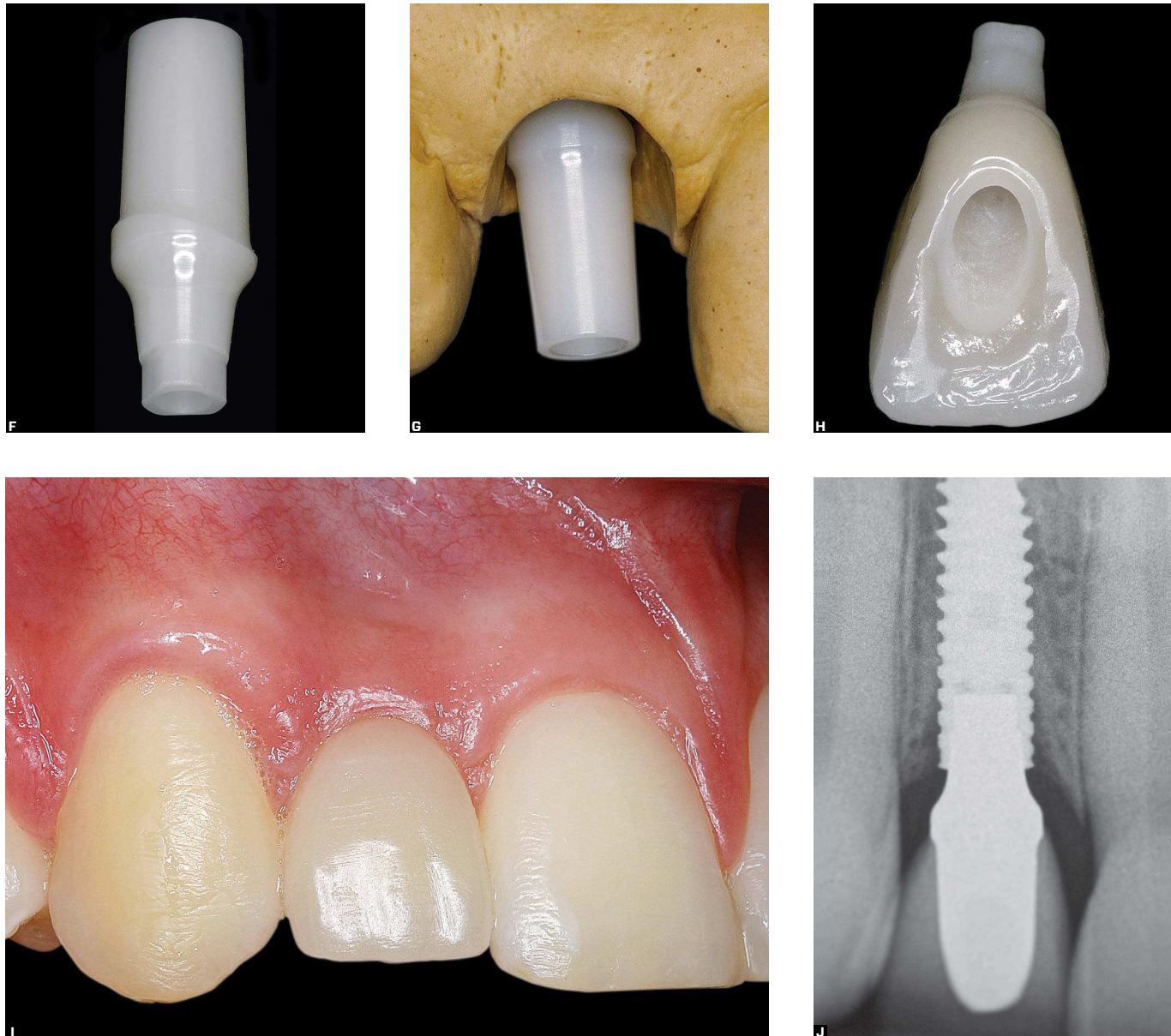


Figure 5 - **F**) Zirconium abutment. Abutment adapted to cast (**G**) and covered with porcelain (**H**). **I**) Ceramic crown screwed to implant; satisfactory transition from surrounding gingiva. **J**) Radiograph shows satisfactory progression of peri-cervical bone and prosthetic abutment with biological concave profile. Clinical and radiographic control at 2 years.

2.3. Immediate technique to obtain gingival contour and emergence profile (Immediate Gingival Conditioning - IGC)

The technique

To achieve the best esthetic results, volume and shape of peri-implant tissues must be harmonious. The gingiva should cover the implanted crown according to previously established esthetic parameters, as regular concave contour, aligned with that of adjacent natural teeth.

The absence or shortage of gingival tissue has been a matter of concern for those who work with implants. During the initial phases of treatment, substantial gingival volume gain should be sought, so that the gingiva can be recontoured in subsequent phases of the treatment, particularly by means of repeated compressive maneuvers. This procedure is satisfactory, although it takes time to complete and achieve successful results.

As an alternative, we suggest a new Immediate Gingival Conditioning (IGC) technique, which consists of a single conservative gingivoplasty. This maneuver is performed using diamond-coated tips of different grain sizes or zirconium tips (Fig 6). Diamond-coated tips should be used at high speed under proper cooling. In contrast, zirconium tips may be used without cooling, which provides better visualization to “sculpt” the gingiva and reduces bleeding to a minimum. Infiltration anesthesia should be used for these procedures. In some cases, when gingival “sculpture” affects a very small area, the procedure may be performed under topical anesthesia, or even with no anesthesia. Its purpose is to remove a very small superficial portion of the gingiva, which results in the creation of the gingival contour and emergence profile without any extra sessions or tissue compression (Figs 7 and 8).

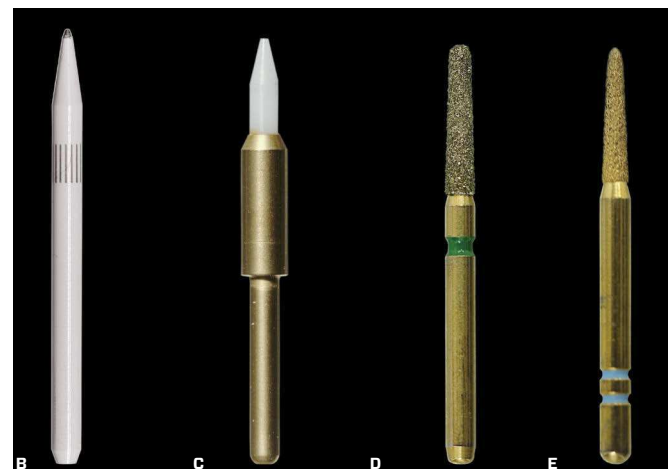
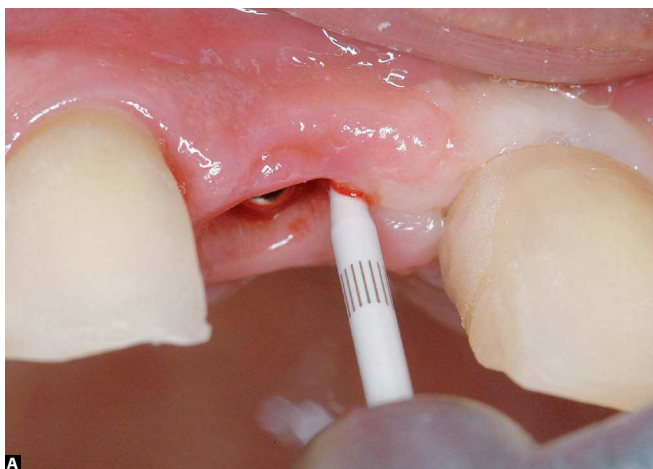


Figure 6 - A) Zirconium tip operated at high speed to prepare gingiva in concave arch shape. Zirconium (**B, C**) and diamond-coated (**D, E**) tips for gingivoplasty.

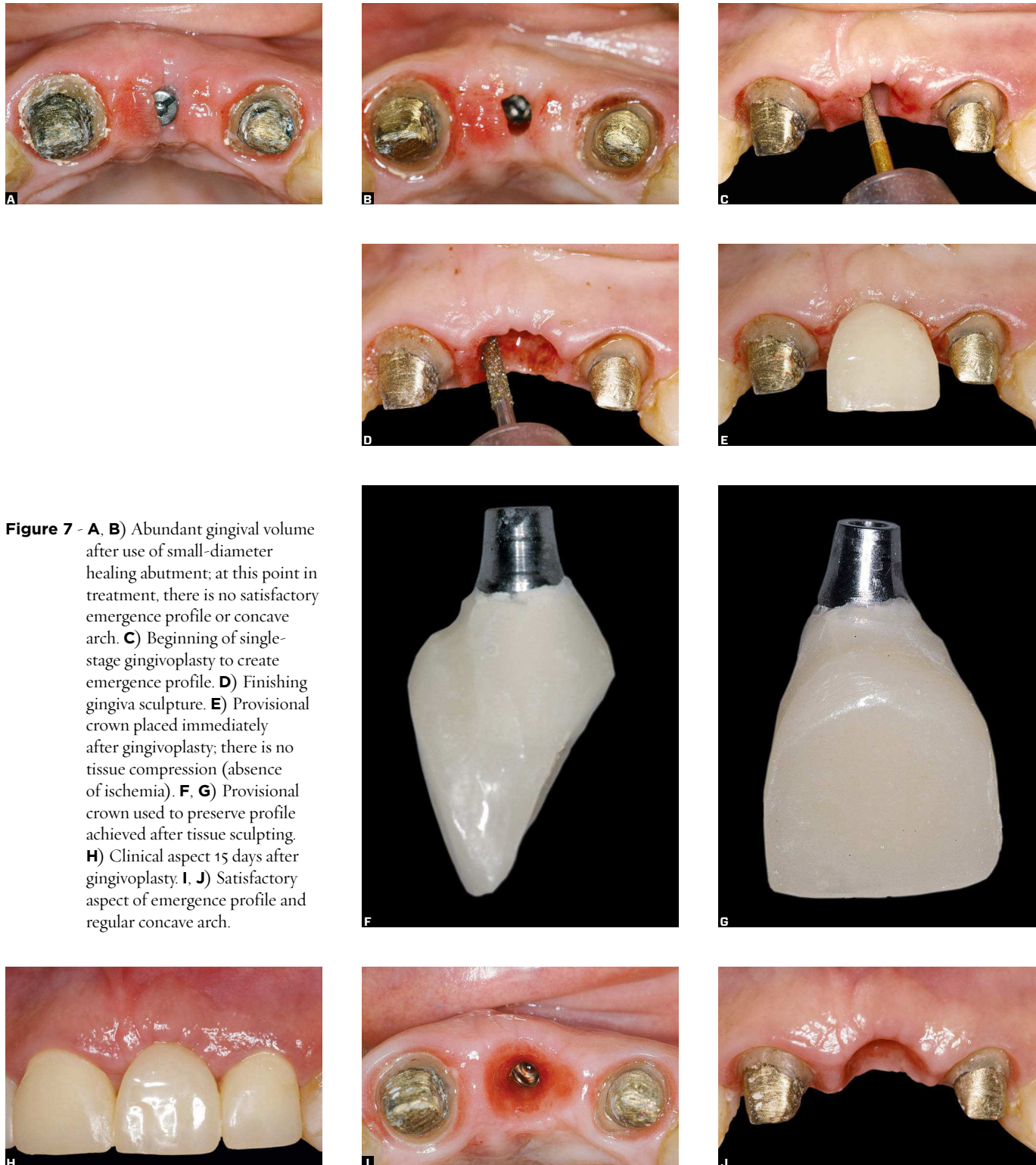
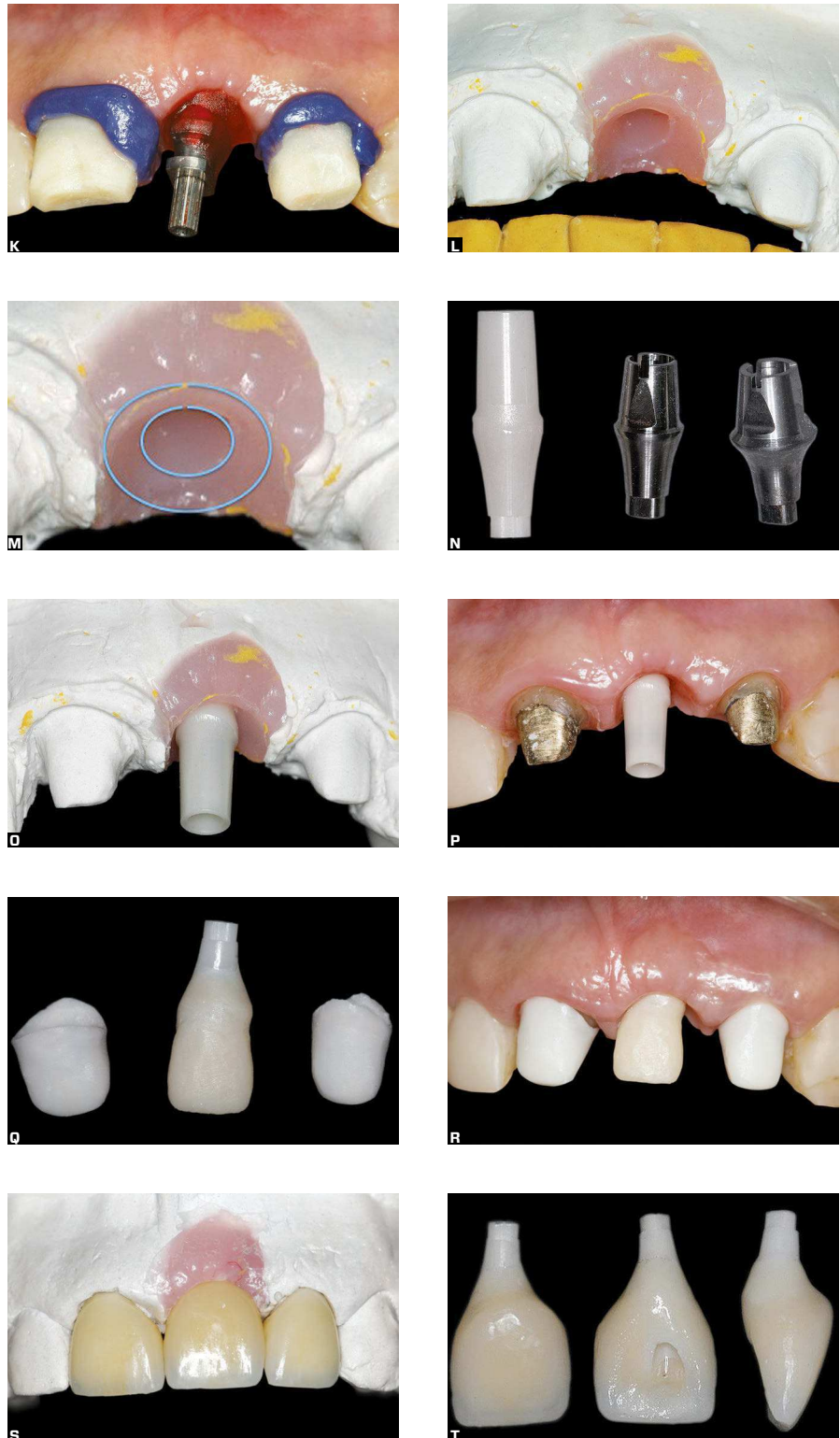


Figure 7 - A, B) Abundant gingival volume after use of small-diameter healing abutment; at this point in treatment, there is no satisfactory emergence profile or concave arch. **C)** Beginning of single-stage gingivoplasty to create emergence profile. **D)** Finishing gingiva sculpture. **E)** Provisional crown placed immediately after gingivoplasty; there is no tissue compression (absence of ischemia). **F, G)** Provisional crown used to preserve profile achieved after tissue sculpting. **H)** Clinical aspect 15 days after gingivoplasty. **I, J)** Satisfactory aspect of emergence profile and regular concave arch.

Figure 7 - **K)** Individual impression using resin tray and Impregnum (#11 and #22), and implant transfer using individual trays. **L)** Working model. **M)** Emergence profile and regular concave arch replicated in resilient artificial gingiva in cast. Notice the internal gingival contour shaped as a bell. **N)** Selection of definitive abutments with concave profiles. **O)** Zirconium abutment placed onto (screwed to) implant analog in cast, and try-in (**P**). **Q)** Zirconium components over preparation of teeth #11 and #22. Notice biological concave profile of prosthetic abutment. Beginning of application of ceramics over zirconium abutment. **R)** Try-in and clinical analysis of abutment and support components. **S)** Finished crowns positioned in working model. **T)** Proximal and buccal views show biological concave profile of prosthetic abutment.



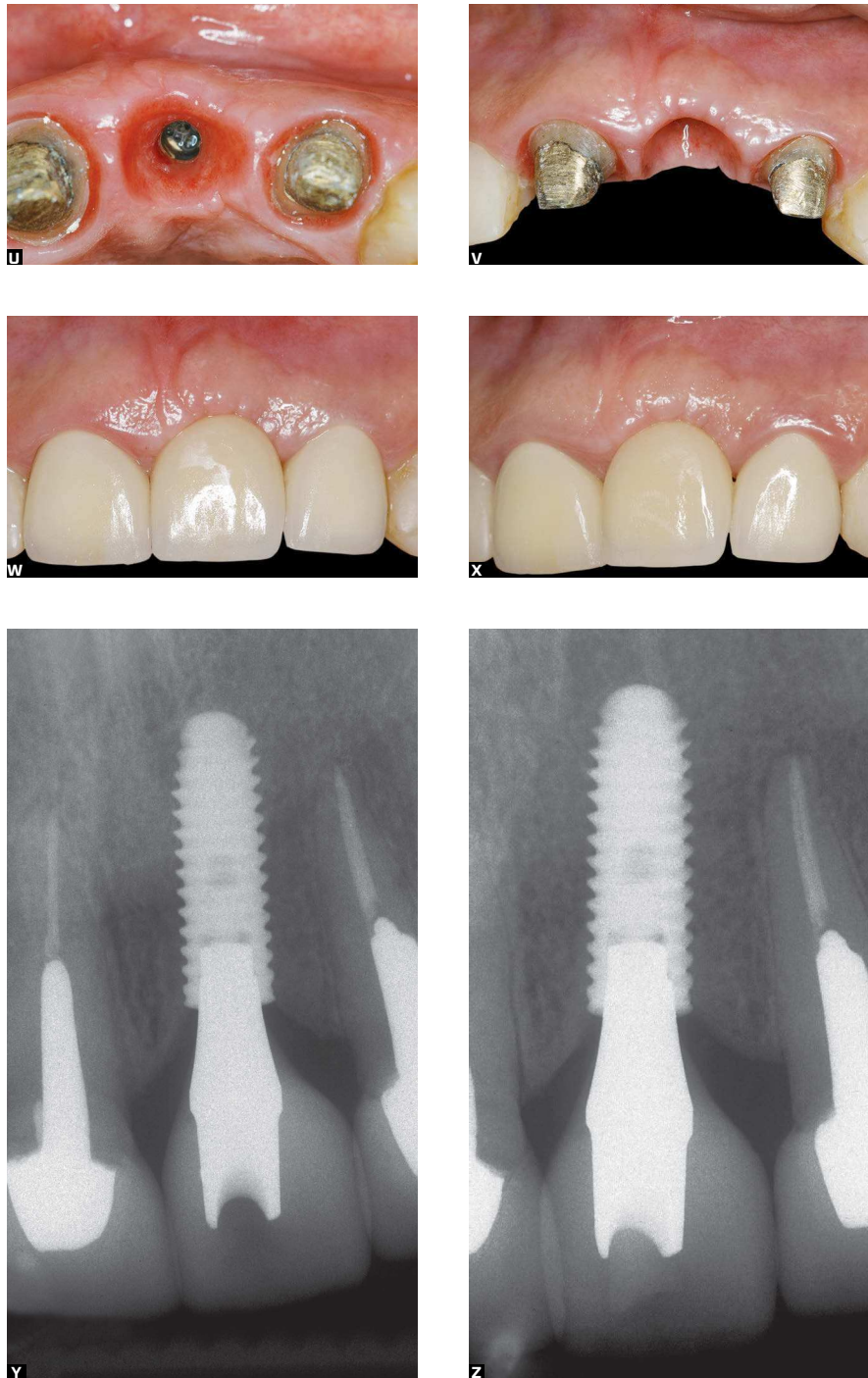


Figure 7 - U) Clinical aspect of gingiva at time of crown placement, showing space for prosthesis contour and emergence profile, and concave arch regular configuration **(V)**. **W)** Placement of definitive crowns. **Y)** Immediate radiographic control. Notice biological concave profile of prosthetic abutment. **X, Z)** Clinical and radiographic 2 years follow-up. Notice gingival and bone stability.



Figure 8 - **A, B**) Diamond-coated tip to reshape gingiva during surgery (IGC) before provisional crown placement. **C**) Crown placed over implant. **D**) Final radiograph shows peri-cervical bone progression.



Figure 9 - Bell: its external design is an example for abutment morphology.

After this intervention, the peri-implant site will be morphologically ready to receive a provisional prosthetic crown with the proper contour, including the biological concave profile of the prosthetic abutment and its coronal contour. The gingival contour of the provisional crown, as well as its biological concave profile, may be previously prepared in the cast. The final anatomy of the internal gingival contour should have the shape of a bell (Fig 9).

Important: the use of abutments with concave profiles (Fig 7N, 7T, 7U, 7V) should be an option whenever the objective is to optimize gingival esthetics. This type of abutment provides more room for the accommodation of cervical soft tissues, and precludes the need of an osteotomy for the placement of conventional abutments with a convex profile, which invariably compromise the preservation and stability of cervical peri-implant bone. Prosthetic abutments may have a slightly concave or concave profile, and their diameter should always be smaller

than that of the implant platform.⁸ This distribution results in more space and, consequently, more gingival tissue, which results in greater stability, as well as protection and stability of the cervical peri-implant bone. For these reasons, they are called prosthetic abutments with a biological profile. The concave profile may be produced for any type of connection between prosthetic abutment and implant. This facilitates the use of internal connections, such as the Cone Morse connection, which increases the concavity of abutments and results in a greater amount of gingiva around the prosthetic abutment.

Bone stability and cervical peri-implant gingiva are much more closely related to the morphological and functional characteristics of prosthetic abutments than to the type of implant-to-prosthetic abutment connection.

Gingival recontouring, both in fresh and healed extraction sockets, is one of the most important steps in achieving satisfactory esthetic results. When we understand the importance of respecting the implant-crown-gingiva triad, the classical definition of esthetics as the harmony of all elements gains a profoundly more complex meaning.

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