

A Novel Approach to Preserve the Buccal Wall in Immediate Implant Cases: A Clinical Report

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The aim of this article is to present a novel approach to preserve the buccal wall when performing immediate implants. After immediate implant site preparation, the socket is filled with Bio-Oss collagen and trimmed in a cone form to closely adapt to the buccal wall. Then, the implant is placed with low-rotation-speed condensing Bio-Oss collagen buccally. With this technique, the remodeling of buccal wall after immediate implant placement may be reduced.

Key Words: *immediate implantation, alveolar bone loss, bone remodeling, Bio-Oss collagen*

INTRODUCTION

The procedure of immediate implants, especially in the esthetic zone, is a challenge to clinicians because of the modeling/remodeling (external changes/internal changes) of the buccal wall with direct consequences on the stability of both hard and soft tissues. This is a physiological phenomenon that occurs during the healing process of the wound,^{1,2} after tooth extractions, and even following an immediate implant. Many authors³⁻¹³ state that this clinical procedure does not prevent vertical or horizontal bone resorption, there is a significant bone reduction, and bone regeneration techniques should be applied in most of the cases.

The Proceedings of the Third ITI Consensus Conference¹³ about implants in postextraction sites present some of the consensus statements regarding this theme:

- External resorption (modeling) of the socket walls occurs during bone healing.
- There is spontaneous bone healing and osseointegration of implants with a horizontal defect dimension of 2 mm or less.

- Bone regeneration procedures are recommended when there is a horizontal defect dimension larger than 2 mm and/or nonintact socket walls.

However, the same Consensus Conference¹³ concludes that there is a lack of comparative analysis of different methods of bone augmentation with regard to the stability over time, especially concerning the behavior of the buccal bone plate.

Buccal wall changes are dependent mostly on the thickness of the buccal plate, which should be at least 1.8- to 2-mm thick,¹⁴⁻¹⁷ although the trajectory of the implant¹⁶ more toward the buccal wall, or an excessive insertion torque,¹⁸ can also promote these changes because of an inadequate blood supply.

However, an adequate buccal plate thickness is not present in most clinical situations,^{17,19} and bone regeneration procedures should be considered. Also, to prevent this buccal wall modeling/remodeling, the implant should be placed more palatally to avoid pressure against the buccal plate and to facilitate bone-grafting outcomes, since a gap is always left between the implant and the buccal bone.¹⁶ When this gap is greater than 2 mm,⁶ bone gap filling is indicated, and it can be executed with a natural bone-grafting material, such as Bio-Oss (Geistlich Pharma AG, Switzerland) made from the mineral portion of bovine bone or with a grafting material that combines bone particles with colla-

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gen, such as Bio-Oss collagen. The latter is a combination of Bio-Oss 100 mg spongiosa granules with 10% highly purified porcine collagen type I (90:10 ratio), with the advantage of being a moldable block with favorable handling properties, especially indicated for socket preservation procedures.^{9,11,20,21}

Evaluation of the ridge-modeling process can be observed in vivo by means of a reentering surgery and measurements with a caliper instrument.¹² However, this has the disadvantage of promoting new wound formation. The evolution of dental-imaging techniques over the past years,^{22–24} mainly with cone-beam computerized tomography (CBCT) scans, may help as a main tool to establish more precise measurement protocols. The patient may be subjected to a new CBCT scan in a follow-up examination after 1 or 2 years, and new measurements may be performed, allowing comparison with the previous measurements. However, Fickl et al²⁵ considers the major problem of this comparison to be with the correct superimposition of the images and their matching to allow measurement.

As this clinical situation has no protocol established in the literature, the aim of this article is to reveal a novel approach to preserve the buccal wall dimensions when performing an immediate implant in the esthetic zone and also to present the contribution of CBCT scans in the evaluation of these cases.

CLINICAL REPORT

Preoperative information and treatment planning

A 60-year-old male patient was referred to our dental clinic complaining of a functional problem, with a major difficulty in chewing due to the absence of multiple teeth and mobility and pain related to the remaining teeth. The patient was a nonsmoker, systemically healthy, and referring no medical condition that negatively affected implant placement.²⁶

A preliminary clinical and radiographic (panoramic X-ray) examination revealed generalized severe chronic periodontal disease, with periodontally compromised teeth in both jaws (Figure 1). In the maxilla, there were five teeth remaining in the anterior maxilla (#6–#10) and tooth #16. In the mandible, the patient presented 11 teeth (#20–#29,

#32). All maxillary teeth presented a grade II mobility.²⁷

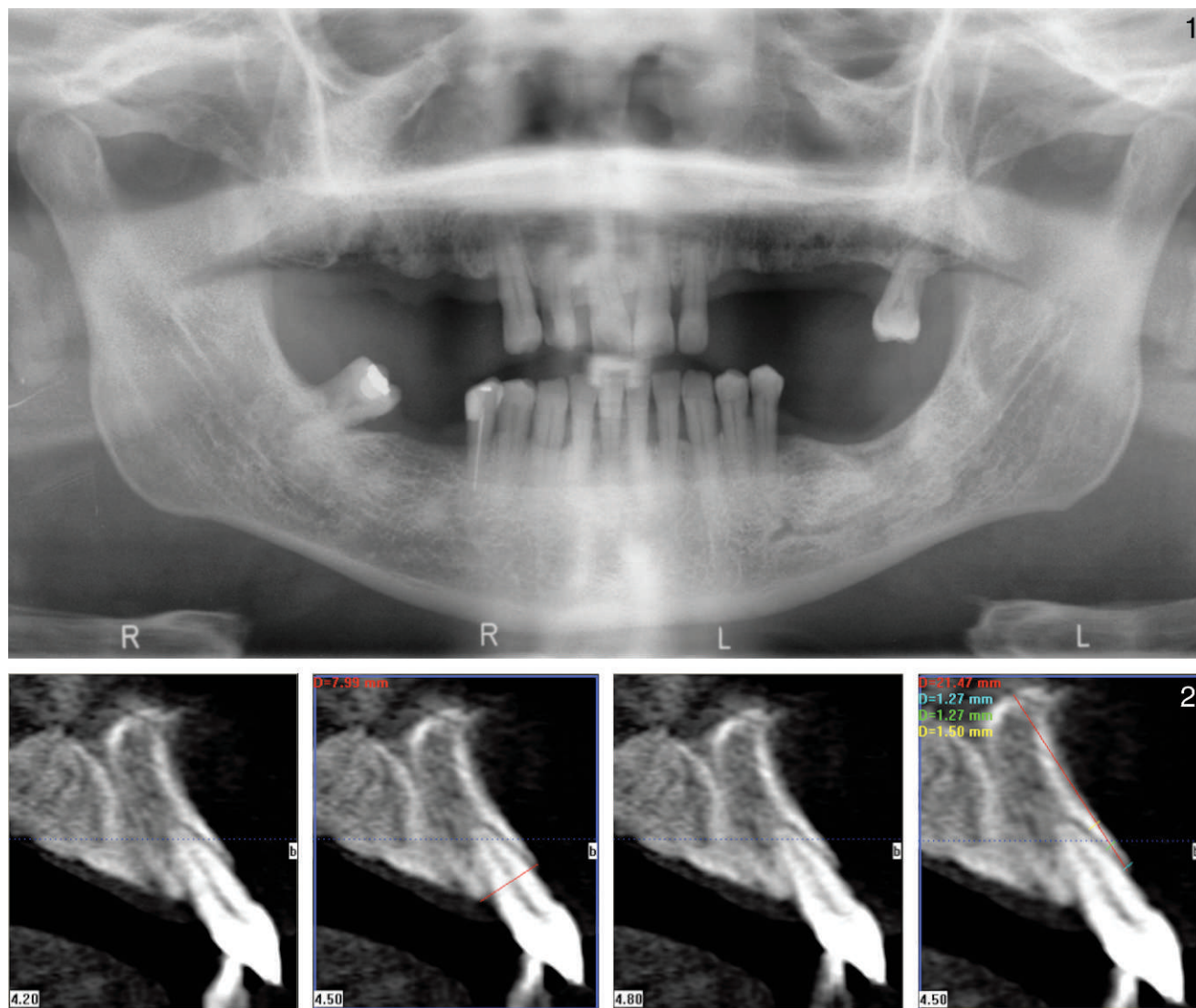
A CBCT scan (I-CAT Imaging Sciences, Hatfield, Penn) was also performed, mainly to evaluate the buccal wall in the anterior remaining maxillary teeth. Vertical bone loss associated with periodontal disease was observed ($\cong 5$ mm related to the cement-enamel junction). No fenestrations or dehiscences were observed in the remaining buccal plates. In tooth 21, buccal plate thickness was less than 2 mm, which would indicate regenerative procedures to prevent buccal wall modeling/remodeling after tooth extraction (Figure 2).

Considering the chief complain of the patient, the following treatment plan was established:

1. Extraction of teeth #6, #7, #8, #9, #10, and #32 and nonsurgical periodontal treatment of mandibular teeth (scaling and root planning)
2. Implant placement on #3, #5, #7 (immediate), #9 (immediate), #11, and #14 positions (Straumann SLActive)
3. Full-arch immediate loading metal-reinforced acrylic fixed provisional prosthesis
4. Full-arch fixed metal-ceramic implant-supported maxillary prosthesis
5. Single-unit implant placement on #19 and #30 (Straumann SLActive)

Surgical treatment

After periodontal treatment, a surgical procedure was performed consisting of the extraction of the remaining anterior maxillary teeth and immediate placement of six implants on #3, #5, #7 (extraction socket), #9 (extraction socket), #11, and #14 positions. The implant surgery was flapless because of the availability of soft and hard tissues (Figure 3) to reduce the postoperative inflammation and edema and so increase patient comfort. Before immediate implant placement (Straumann SLActive 4.1×12 mm, Straumann, Basel, Switzerland) into the fresh extraction socket of tooth #9, the buccal bone wall was inspected with a periodontal probe to measure the distance of the gingival margin to the bone crest. Apart from some vertical bone loss already present because of previous severe periodontitis condition, the existing buccal wall and the facial soft tissue remained largely intact after tooth removal (there were no bone fenestrations/dehiscences). The extraction socket was then classified as

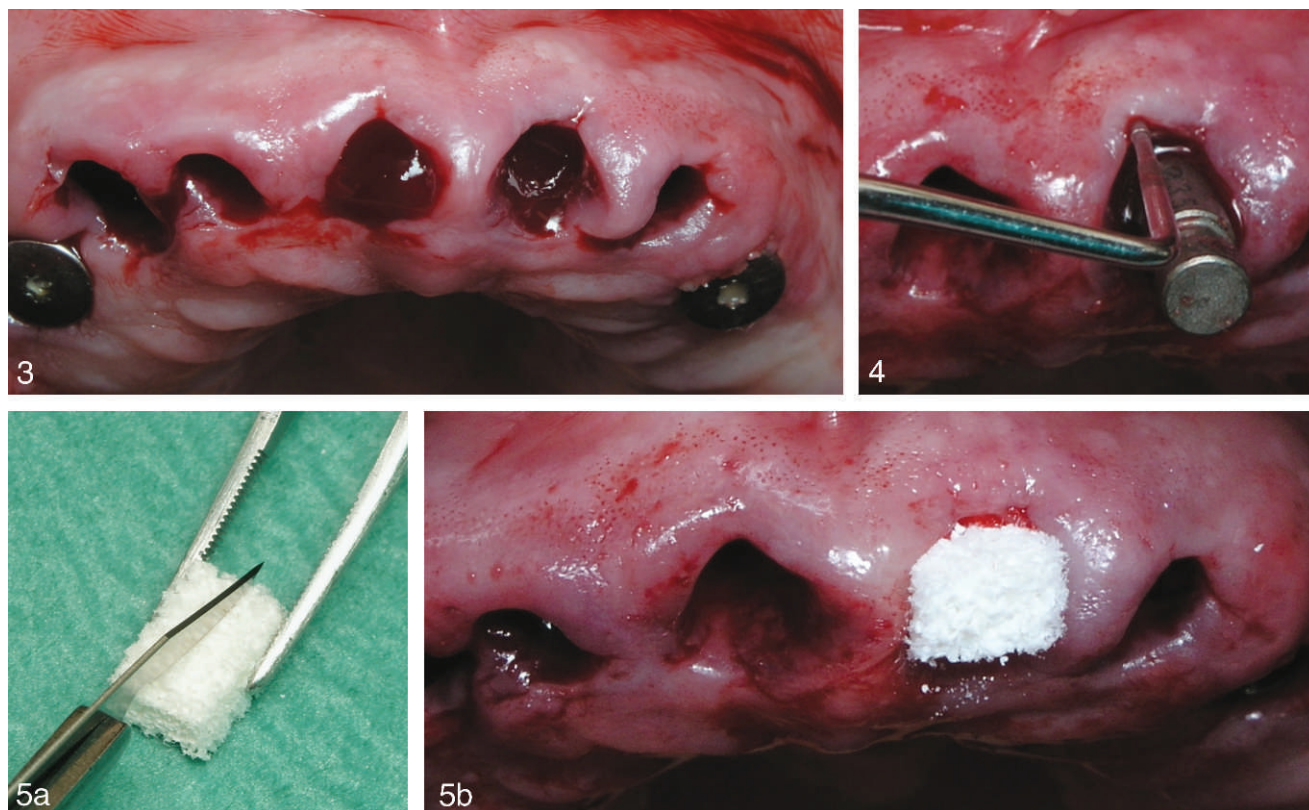


FIGURES 1 AND 2. **FIGURE 1.** Preoperative panoramic X-ray. Periodontally compromised anterior upper teeth. **FIGURE 2.** Cone-beam computerized tomography scan image of tooth 21 and its socket, 0.3 mm slices. Buccal-lingual dimension of the socket: 7.99 mm. Dimensions of the buccal wall of tooth 21 ranging from 1.27 to 1.50 mm. Distance bone crest–nasal floor of 21.47 mm.

a type I.²⁸ A horizontal buccal gap of 2 to 3 mm was also detected between the 3.5-mm-diameter depth gauge and the remaining buccal wall (Figure 4). The bone gap filling was then indicated, and it was performed before implant placement. Bio-Oss collagen (Geistlich Pharma AG) was selected for this bone regeneration procedure. Bio-Oss collagen was trimmed to a cone form to closely adapt to the socket buccal wall (Figure 5). The thickness of the biomaterial is dependent on the dimension of the existing gap found after placing the depth gauge into the implant-prepared site and measuring its gap distance to the internal socket buccal wall. As the implant will promote a later condensation of

the biomaterial when it is being placed, the thickness of the Bio-Oss collagen block should be approximately double the gap (in this particular case, 6 mm approximately) since it will suffer an approximate 50% volume reduction as it is condensed.

The implant was then installed with a low-speed rotation (15 rpm), and the Bio-Oss Collagen was pushed buccally, condensing it to approximately 50% of its volume. All of the gaps between the implant and surrounding buccal bone wall were filled with Bio-Oss collagen in such a way with these biomaterial particles (Figure 6). As this was an immediate implant flapless placement, the implant



FIGURES 3–5. **FIGURE 3.** Extraction of teeth 13, 12, 21, and 22 in order to place implants on 16, 14, 12 (immediate), 21 (immediate), 23, and 26. Flapless surgery. **FIGURE 4.** Implant surgery procedure, 3.5-mm depth gauge inserted. Buccal wall inspection with a periodontal probe. **FIGURE 5.** Bio-Oss collagen trimmed to a cone form was inserted and condensed in the extraction socket, close to its buccal wall.

neck position was determined, taking into account the buccal bone crest level. The implants (Straumann SLA Active, SP, diameter 4.1) were placed leaving the shoulder of the implant at the level of the buccal bone crest with its 1.8-mm machined surface neck inserted into bone.

Immediately after implant placement, impressions were taken to deliver a full-arch acrylic

provisional screw-retained prosthesis in 24 hours (Figures 7 and 8).

Both implants and soft tissues healed uneventfully. Six months later, a full-arch fixed metal-ceramic prosthesis was delivered (Figures 9 and 10). No clinically significant changes were observed in the facial soft tissues of the immediate implants as compared with the gingival margins obtained

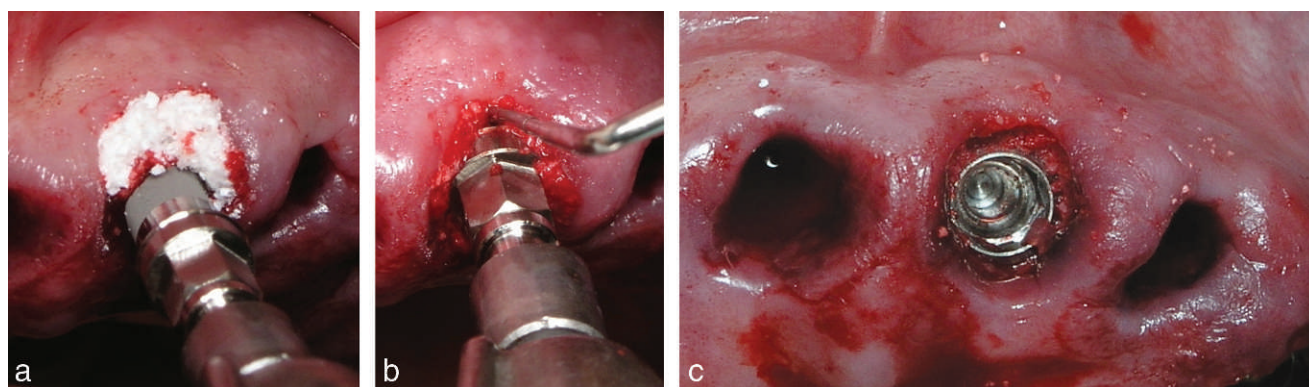
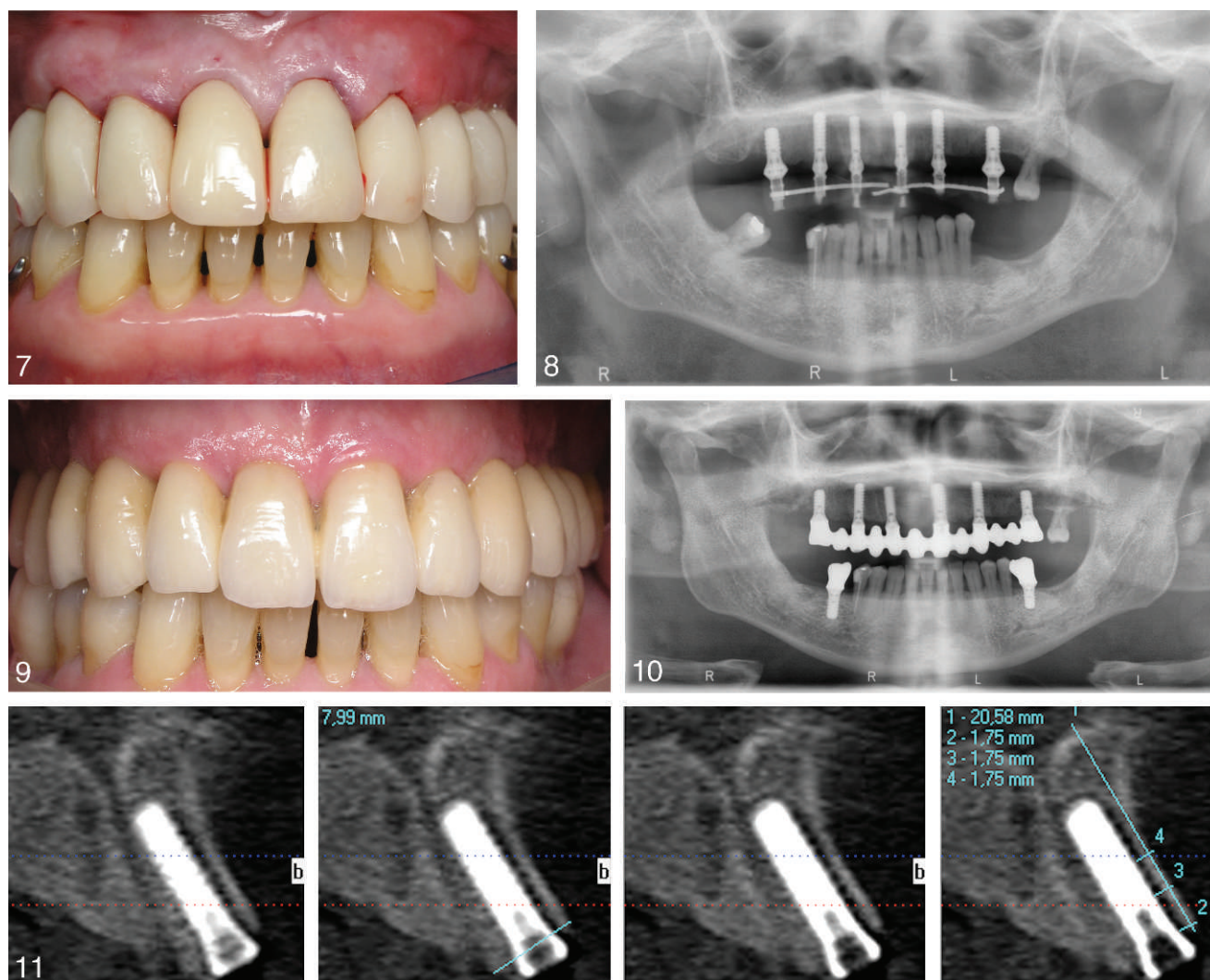


FIGURE 6. Immediate implant placement in 21 position.



FIGURES 7–11. **FIGURE 7.** Full-arch metal-reinforced acrylic fixed provisional screw-retained prosthesis. **FIGURE 8.** Panoramic X-ray of the full-arch metal-reinforced acrylic fixed provisional screw-retained prosthesis. **FIGURE 9.** Full-arch metal-ceramic fixed prosthesis in the maxilla. **FIGURE 10.** Panoramic X-ray of the full-arch metal-ceramic fixed prosthesis in the maxilla, and single-unit implants on 36 and 46 positions. **FIGURE 11.** Cone-beam computerized tomography (CT) scan images of the implant placed in 21 (0.3 mm slices), 2 years after the surgery, with the removal of the full-arch metal-ceramic prosthesis to avoid noise in CT scan images. Thickness of the implant buccal wall on 21: 1.75 mm; vertical distance buccal bone crest–nasal floor: 20.58 mm.

after 6 months of healing with a provisional prosthesis.

At a 2-year follow-up visit, a new CBCT scan was made to evaluate the behavior of the buccal wall, and the following result was observed: preservation of the buccal wall dimensions, with no gap between the implant and the buccal wall and vertical stability of the bone crest, when the distance between the buccal bone crest and the nasal floor was compared (21.47 mm vs 20.58 mm; Figure 11). Peri-implant measures were performed with a computerized periodontal probing system (Florida Probe) and

were considered normal, according to the Albrektsson criteria of success²⁹ (Figure 12).

DISCUSSION

In the present clinical case, the immediate implants have been placed palatally, leaving a horizontal gap larger than 2 mm. To better promote socket healing (reduce horizontal and vertical buccal plate remodeling), the usual bone regeneration technique consists of the impaction of Bio-Oss particles into the gap, after implant placement, as a final surgical

Periodontograma



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FIGURE 12. Peri-implant measurement chart at the 2-year follow-up visit.

step.¹⁸ As stated by Becker and Goldstein,¹⁸ when a bone gap is present there is no need to surgically advance a flap. The bone regeneration material is left exposed, and after a few weeks, a part of the material will exfoliate and soft tissue will migrate over this and enhance a good support of soft tissues. This is particularly relevant in the anterior zone, where most extraction sites have a buccal bone wall inferior to 1 mm,^{17,19} meaning that, in most of the clinical situations, an augmentation procedure should be applied to provide adequate bony contours around the implant.

De Sanctis³⁰ reported 2.5 mm of bone modeling (resorption) of the buccal plate and concluded that this occurrence could limit the immediate implant surgical approach. Araujo et al⁵ concluded that immediate implant placement in fresh extraction sockets failed to preserve the hard-tissue dimension of the ridge following tooth extraction. To counteract this statement, the same author^{9,11} inferred that the placement of a biomaterial in an extraction socket may affect the modeling and thus counteract the marginal ridge contraction that naturally occurs following tooth removal.

In our opinion, this previously described technique of inserting the biomaterial into the gap between the buccal plate and the implant surface¹⁸ does not ensure good control of the particle condensation along the implant, and as such, the preservation of the thin buccal wall can be affected. Although Becker and Goldstein¹⁸ describe the exfoliation of some of the particles and the soft-tissue migration as enhancing the healing, in our opinion this may counteract the effect that it is expected from the biomaterial because of the loss of some bone graft volume as well as the less effective condensation of the material. The technique presented here uses a material (Bio-Oss collagen) that is moldable and easy to place into the extraction socket, just before implant placement (as opposite to the traditional technique). As all Bio-Oss particles are linked by the porcine collagen into a block, there is a better insertion/condensation of the material during the implant insertion, which we believe may contribute to reduce the marginal ridge contraction and, in consequence, better support the hard and the soft buccal tissues. This is in agreement with Araujo et al,^{9,20} who stated that the presence of Bio-Oss collagen remain unchanged during the 4-week healing phase and apparently

promotes de novo hard-tissue formation, especially in the cortical wall of the extraction site, preserving the ridge and compensating, at least temporarily, the marginal ridge contraction. On the contrary, the porcine collagen material is rapidly removed during the first week because of the hydrolytic enzymes released by the polymorphonuclear cells during this inflammatory phase of the healing process. Nevertheless, this collagen resorption will not affect the stability of the graft, since the particles will be trapped in the fibrin network of the coagulum that generates in the first 3 days of the healing phase.²⁰

Although it has a reduced follow-up time, it seems that the technique here presented is easy to perform and may play an important role in buccal bone wall stability over time, as it minimizes the risk of bad condensation of particulated bone graft material into immediate implant buccal gaps. After 2 years of immediate implant placement, the CBCT scan showed vertical and horizontal stability of the buccal bone, and peri-implant soft tissues revealed no abnormal values concerning pocket depths and attachment levels at follow-up visits.

However, randomized clinical trials with longer follow-up should be designed to validate this technique scientifically and compare it to the currently most accepted particulate bone approach.

ABBREVIATION

CBCT: cone-beam computerized tomography scan

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