

Crestal Ridge Width Changes When Placing Implants at the Time of Tooth Extraction With and Without Soft Tissue Augmentation After a Healing Period of 6 Months: Report of 24 Consecutive Cases



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The esthetic outcome of an implant-supported restoration is first of all dependent on the soft tissue volume. Since the labial bone plate resorbs in every direction after tooth extraction, even when an implant is placed immediately, most patients end up with compromised esthetics. Twenty-four patients were treated consecutively with implants placed in the maxillary anterior area at the time of tooth extraction using two different treatment modalities. The first 12 patients were treated without raising a flap, whereas a subepithelial connective tissue graft was placed using the tunnel technique in the labial area of the subsequent 12 patients at the time of tooth extraction and implant placement. The dimension of the labial volume was measured before treatment and 6 months after implant placement. The results show an average loss of volume in the nongrafted group of 1.063 mm, whereas in the grafted group, there was a slight gain of 0.34 mm. These results demonstrate the effectiveness of placing a soft tissue graft at the time of immediate implant placement in the esthetic zone. (Int J Periodontics Restorative Dent 2011;31:9–17.)

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The esthetic outcome of an implant-supported restoration is dependent on the soft tissue contour.¹ The goal is for the restoration to blend in perfectly and emerge from the peri-implant sulcus in harmony with the neighboring teeth. Placement of implants at the time of tooth extraction is shown to be successful regarding osseointegration^{2–5} and has been described to be an ideal treatment option in the esthetic zone.^{6,7} However, there are risks regarding the esthetics of such a treatment modality.

The most negative influence on the soft tissue height in the labial area comes from an implant positioned too far labially.⁸ But even if an implant is placed perfectly, it is most often not possible to maintain the existing tissue volume. There are dimensional ridge alterations that occur following tooth extraction. Several studies show that the labial bone plate changes in height and thickness,^{9,10} and to place an implant at the time of tooth extraction does not help to maintain the height of the labial bone plate^{8,11,12} or the labial bone contour.^{13,14}

Since the natural thickness of the connective tissue overlying the bone around implants at the labial aspect ranges from 2.8 to 3.8 mm,¹⁵⁻¹⁸ the consequences of labial bone plate resorption after tooth extraction are midfacial soft tissue recession and missing labial tissue volume, which lead to a compromised esthetic result.¹⁹

What is not described in the literature but known from clinical experience is that the soft tissue thickness also changes after tooth extraction. The question, therefore, is if by thickening the soft tissue with a soft tissue graft, the loss of bone volume in the labial area can be compensated for and maintained over time.

The goal of this case report is to evaluate the crestal ridge width changes after placement of implants at the time of extraction, with and without placement of a soft tissue graft, after a healing period of 6 months.

Method and materials

Twenty-four patients treated with implants in the anterior maxilla (10 central incisors, 12 lateral incisors, 2 canines) placed at the time of tooth extraction were included in this study. The reasons for tooth extraction were endodontic failure and caries lesions combined with root or crown fractures. No tooth was removed because of advanced periodontal disease. Tooth extraction was performed under local anesthesia, and all extraction sites had intact bone walls. The teeth were extracted without raising a flap, and implants (Biomet3i or SPI, Thommen Medical) were placed in

a more palatal position to avoid any pressure on the labial bone plate. No membranes were used and no filler material was inserted into the gaps between the implants and surrounding bone.⁶ Healing posts were placed and a removable provisional prosthesis, which had no contact with the healing post, was inserted.

The first 12 consecutive patients treated (4 central incisors, 6 lateral incisors, 2 canines) did not receive any tissue augmentation procedure (Figs 1a to 1f). In the subsequent 12 patients treated (6 central incisors, 6 lateral incisors), a subepithelial connective tissue graft, harvested from the palate,²⁰ was placed in the labial area at the time of tooth extraction and implant placement. The split-flap preparation of the graft site was done using a microsurgical knife and the tunnel technique^{21,22} without any incision in the papillary area; the graft was stabilized using sutures (Gore-Tex, W.L. Gore) (Figs 2a to 2h).

All patients rinsed with a 0.2% chlorhexidine solution (Curasept, Curadent Healthcare) twice a day during the first 14 days postsurgery. Sutures were removed 10 days after surgery for patients who received the graft.

Clinical measurements were performed after implant insertion using a periodontal probe (William, Hu-Friedy). The probe was placed horizontally, perpendicular to the long axis, and through the center of the implant.^{13,14} After 6 months, clinical measurements were repeated.

Photographs were taken perpendicular to the long axis of the implant before treatment, during and

Fig 1 Patient treated without any tissue augmentation procedure.



Fig 1a Treatment called for the extraction of the maxillary right central incisor.



Fig 1b An implant was placed at the time of tooth extraction without raising a flap. There was no deficit of the labial tissue dimension.



Fig 1c After 6 months of healing, reduction in the labial tissue dimension was visible.



Fig 1d Optimal results were apparent after finalizing the treatment with an all-ceramic reconstruction on the implant and a porcelain laminate on the adjacent central incisor.

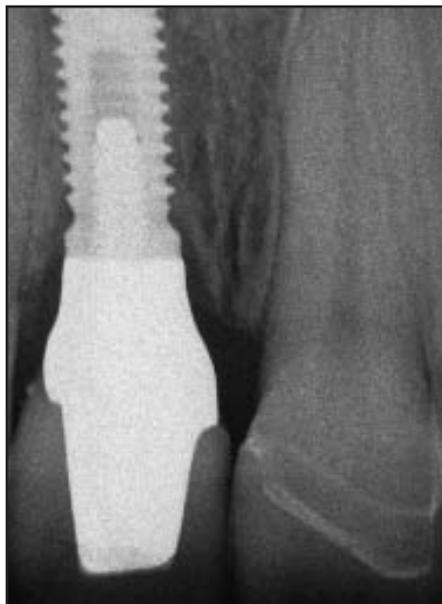


Fig 1e (left) Radiograph of the definitive restoration.

Fig 1f (below) Final smile line. A shadow was visible due to the deficit of the labial tissue dimension in the region of the replaced right central incisor.



Fig 2 Patient treated with a subepithelial connective tissue graft at the time of tooth extraction and implant placement.



Fig 2a Treatment called for the extraction of the maxillary left central incisor.



Fig 2b After tooth extraction, an implant was placed immediately.

after implant placement, and after a healing period of 6 months, as well as from the smile line after insertion of the definitive reconstruction. The final esthetic result was judged to be good or compromised depending on the appearance of a shadow in the midcrestal region (Figs 1f and 2h).^{1,19}

Results

All implants integrated and the definitive suprastructures were inserted as planned. No implant was placed in a labial position.⁸

During 6 months of healing, the dimension of horizontal resorption of the labial tissue was 1.063 mm in the nongrafted group, with a minimum of 0.25 mm and a maximum of 2.0 mm. Ridge resorption was between 0.25 and 1.0 mm in 50.1% of patients,

between 1.0 and 1.5 mm in 33.3% of patients, and between 1.5 and 2.0 mm in 16.6% of patients.

The corresponding gain in labial tissue dimension for the grafted group was 0.34 mm, with a minimum of 0.0 mm and a maximum of 1.5 mm. The gain in the labial tissue was between 0.0 and 0.5 mm in 33.3% of patients, between 0.5 and 1.0 mm in 50.1% of patients, and between 1.0 and 1.5 mm in 16.6% of patients.

In the nongrafted group, the esthetic outcome with respect to the appearance of a disturbing shadow resulting from loss of part of the midcrestal ridge width did not occur in three patients, whereas a negative effect was recorded in nine patients. In the grafted group, no compromised esthetic result was seen with respect to the appearance of a disturbing shadow.

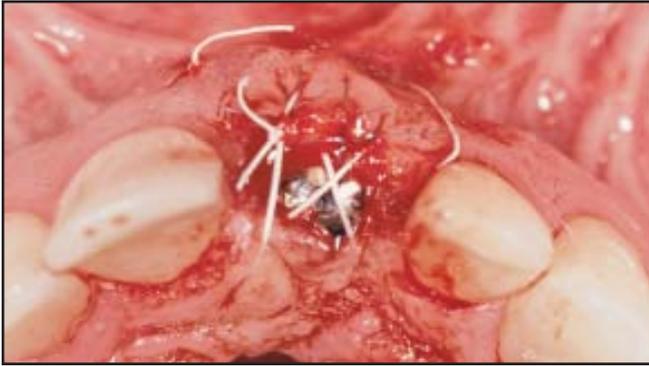


Fig 2c A connective tissue graft was placed labial to the extraction site using the tunnel technique.



Fig 2d An ideal tissue dimension was present after 6 months of healing.



Fig 2e The definitive porcelain-fused-to-metal crown was inserted.



Fig 2f Occlusal view showing the similar labial volume at both central incisors.



Fig 2g (left) Radiograph of the definitive restoration.

Fig 2h (below) Final smile line. No shadow was visible.



Discussion

After the initial enthusiasm for the treatment option of placing implants immediately after tooth extraction in esthetically demanding situations,⁶ clinicians became more and more careful in selecting the patients to receive treatment. The biggest benefit of this type of treatment is the preservation of the existing papillae and the lack of risk of creating scar tissue. But it is also well known that a certain reduction of the soft tissue height on the labial aspect of the implant must be accepted.⁶⁻⁸ Based on clinical experience, the following parameters for choosing the immediate approach in esthetically demanding patients are important: no bone defect around the tooth to be extracted, a soft tissue level that would still be in harmony with the gingival level of the adjacent teeth after some shrinkage in the apical direction, and a thick biotype. A "straight" ridge is an advantage, since soft tissue shrinkage is more pronounced in convex ridges. To compensate for the soft tissue shrinkage in the apical direction, forced eruption prior to tooth extraction is a useful technique.²³ A flapless technique is also required.²⁴

But still, the loss of tissue volume in the labial area remains. In two clinical studies, the average horizontal bone resorption was 1.9 mm 4 to 6 months after immediate implant placement using a full-flap procedure.^{13,14} In the present study, the average horizontal resorption of the labial tissue dimension was 1.063 mm. It is well known that the full-flap

procedure shows more bone remodeling when compared to the flapless technique.²⁴

To compensate for this expected loss, tissue augmentation procedures are used. In one clinical study, the use of a resorbable barrier membrane used to cover the gap between the immediately placed implant and the labial bone plate was compared to the technique of filling in this gap with autologous bone chips and to patients in whom no augmentation procedure was performed.²⁵ The average loss of labial tissue volume, measured after 6 months, was 1.2 mm for the membrane group, 1.9 mm for the autologous bone chip group, and 1.1 mm for the nonaugmented group.

In another clinical study, the effectiveness of covering the gap between an immediately placed implant and the labial bone plate with a nonresorbable or resorbable membrane or by filling in the gap with autologous bone chips with and without covering it with a resorbable membrane was evaluated and compared to a group where no augmentation procedure was performed.²⁶ The reduction of the distance from the labial implant shoulder to the labial bone plate after a 6-month healing period was 22.9% for the nonresorbable membrane group, 60.6% for the resorbable membrane group, 39.1% for the autologous bone chip group, 60.1% for the autologous bone chip group with a resorbable membrane, and 52.5% for the group without an augmentation procedure.



Fig 3 (left) Frontal and (right) occlusal views of the 5-year result of a patient who received a subepithelial connective tissue graft showing stable soft tissue conditions. Even after 5 years, the labial soft tissue dimension did not show any deficit.

Another clinical study evaluated the effectiveness of filling the gap between an immediately placed implant and the labial bone plate with deproteinized bovine bone mineral in one group or with deproteinized bovine bone mineral and the use of a resorbable membrane to cover the gap to maintain the labial bone volume in another, then compared both to a group where no augmentation procedure was performed.²⁷ The reduction of the distance from the labial implant shoulder to the labial bone plate after a 6-month healing period was 15.8% for the group where deproteinized bovine bone mineral was used, 20.0% for the group where deproteinized bovine bone mineral and resorbable membrane were used, and 48.3% for the group without an augmentation procedure.

Each of these studies demonstrates that it is not possible to maintain the entire labial tissue volume with any of the techniques used.

In the present study, no changes of the tissue volume in the labial area of a site where an implant was placed at the time of tooth extraction were recorded in any patient receiving a subepithelial connective tissue graft. An important factor is that the labial bone plate was never exposed, since to bring in the soft tissue graft, a split flap was prepared without touching the periosteum.

Measurements after a longer period of time were not possible in this study since most of the definitive crowns could not be removed. Nevertheless, clinical experience shows a very favorable outcome of all patients receiving a graft after several years (Fig 3).

Conclusion

Horizontal resorption of the labial soft tissue dimension was obvious when placing an implant at the time of tooth extraction in the maxillary anterior area. Use of a subepithelial connective tissue graft at the time of immediate implant insertion in the esthetic zone is an effective treatment option to compensate for the expected loss of labial soft tissue volume and to maintain good esthetic results over time.

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