Outcome of Treatment with Single Implants in Preserved Versus Nonpreserved Alveolar Ridges: A 1-year Cohort Study

Elise G. Zuiderveld, DDS, PhD1/Henny J.A. Meijer, DDS, PhD2/Arjan Vissink, DMD, MD, PhD1/Gerry M. Raghoebar, DMD, MD, PhD1

Purpose: To evaluate the effect of placement of single implants in the esthetic zone of the maxilla in preserved alveolar ridges, compared with nonpreserved alveolar ridges, on the change in midlabial mucosal level, esthetics, marginal bone level, and patient satisfaction. Materials and Methods: Patients with a failing single tooth, and demonstrating a large vertical defect (≥ 5 mm) of the labial wall of the extraction socket, were pre-augmented with a mixture of autologous bone and anorganic bovine bone. A mucosal graft sealed the pocket. After 4 months, a single implant was placed in the preserved alveolar ridge (test group; n = 20). The results were compared with those from patients who had one missing tooth and were treated with placement of an implant in a nonpreserved alveolar ridge, whereby the connective tissue graft was combined with the placement of the implant (control group; n = 20). Changes in midlabial mucosal level were scored on intraoral images. Intraoral radiographs were made to assess marginal bone level changes after definitive crown placement (1 month [T1], 12 [T12] months). The pink esthetic score/white esthetic score at T12 was used to determine esthetics. Patient satisfaction was assessed before treatment (Tpre), and at T1 and T12.

Results: The mean midlabial mucosal level changes were 0.07 ± 0.29 mm and –0.15 ± 0.23 mm at T1 and T12 for the control and test groups, respectively (P = .01). No significant changes were observed for the other outcome variables.

Conclusion: Single implant treatment in a preserved alveolar ridge and nonpreserved alveolar ridge is accompanied by clinically nonrelevant changes in the midlabial mucosal level. Changes in marginal bone level, esthetics, and patient satisfaction were comparable between the groups.

Keywords: alveolar ridge augmentation, connective tissue grafting, esthetics, single-tooth implants

Conventional implant treatment was shown to be predictable in the maxillofacial esthetic zone regarding the rehabilitation of single nonrestorable teeth or in areas where teeth have already been removed. However, significant recession and displeasing peri-implant mucosa esthetics may occur, also in the long term.

A prerequisite for obtaining a favorable outcome seems to be a sufficiently thick labial bone wall. A deficient labial bone wall, as a result of the bone resorption process, can also compromise proper soft tissue support, and thus, the esthetics. It was presumed that a thin gingival biotype reflects a thin labial bone wall, which might, in turn, be accompanied by more substantial resorption of the labial bone wall. Guided bone regeneration to augment a deficient labial bone wall was demonstrated to increase the contour of the labial soft tissue. Peri-implant soft tissue grafting of the labial aspect of the implants is presumed to be a key factor for a maximal esthetic outcome. Therefore, connective tissue grafting at the labial aspect of the implant can increase the contour of the soft tissue and limit the change in the midlabial mucosal level of the implant.

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1Department of Oral and Maxillofacial Surgery, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands.
2Department of Oral and Maxillofacial Surgery, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands; Department of Implant Dentistry, Dental School, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands.

Correspondence to: Dr E.G. Zuiderveld, Department of Oral and Maxillofacial Surgery, Hanzeplein 1, NL-9713 GZ Groningen, The Netherlands. Fax: +31 (0)503611136. Email: e.zuiderveld@umcg.nl

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Some suggest that the extraction socket should be immediately augmented when a tooth is extracted to preserve the alveolar ridge to a maximum extent, and thereby, to limit dimensional changes, especially of the labial bone wall, due to resorption. Moreover, connective tissue grafting may decrease the necessity to rebuild the contour by augmenting the labial bone wall at implant placement. Additionally, socket sealing with a connective tissue graft may limit shrinkage of the contour of the labial soft tissue and maintain the volume of the soft tissue, thereby favoring the esthetic outcome. Sealing an augmented socket with connective tissue probably has a comparable effect on the peri-implant esthetic outcome as performing connective tissue grafting during implant placement. Thus, combining tooth removal with grafting of the alveolus and soft tissue will presumably make any further soft tissue grafting superfluous. Therefore, the present cohort study assessed the effect of placement of single implants in preserved alveolar ridges on the change in midlabial mucosal level, marginal bone level, esthetic rating of soft tissues, and restoration through professional, clinical outcome parameters of peri-implant tissues and patient satisfaction. The resulting effect was compared to the effect of treatment with single implants in nonpreserved alveolar ridges simultaneously with connective tissue grafting.

**MATERIALS AND METHODS**

**Patient Selection**

Patients with a single failing tooth in the maxillofacial esthetic zone received a single implant placed in the preserved alveolar ridge (test group). The failing tooth of each ridge-preservation case was extracted atraumatically without raising a mucoperiosteal flap. The labial bone wall of the extraction socket displayed a vertical defect of ≥ 5 mm, according to a postextraction bone sounding technique. Thereupon, the extraction socket was augmented with autologous bone from the maxillary tuberosity and anorganic bovine bone (Geistlich Bio-Oss, Geistlich Pharma). After shaping the bone graft to fit the labial bone wall defect, a 1:1 mixture of the bone substitute and autogenous bone was applied on top of this mixture to seal the alveolus, followed by implant insertion after 4 months.

The preserved alveolar ridge group patients were compared with patients presenting with an already-missing single maxillary tooth (control group). The nonaugmented extraction socket had healed unassisted for at least 3 months. Both the preserved alveolar ridge and nonpreserved alveolar ridge patients fulfilled the following criteria:

- ≥ 18 years of age
- Good oral hygiene (plaque and sulcus index ≤ 1)
- ≥ 6 mm diastema width
- No active periodontal disease (probing pocket depths ≤ 3 mm, no bleeding on probing)
- Nonsmoker
- No medical and general contraindications (ASA score ≤ II, no head and neck radiotherapy, no pregnancy).

Before being enrolled, the patients signed an informed consent form. Approval was obtained from the authors’ Medical Ethical Committee (NL43085.042.13). The study was listed in a trial register (www.trialregister.nl: NTR3815).

**Surgical and Prosthetic Procedures**

Local anesthesia was applied in all surgical procedures. Antibiotic prophylaxis comprised amoxicillin or clindamycin for 7 days. The patients had to rinse their mouth twice a day with a 0.2% chlorhexidine mouthwash for 7 days.

The same procedure was used to insert the implant in both groups. The alveolar ridge was exposed by elevating a minimal mucoperiosteal flap with a slightly palatal crest-incision (Figs 1a and 2a). A surgical guide was used to safeguard the planned position. The implants (NobelReplace CC, Nobel Biocare) were placed with 45 Ncm (Figs 1b and 2b). A good emergence profile was achieved by placing the implant shoulder 3 mm apical to the most labial and cervical aspect of the prospective implant crown and leveling it to the alveolar bone. When the thickness of the labial bone wall of the implant was < 2 mm, a 1:1 mixture of autologous bone and anorganic bovine bone was applied labially of the implant. The augmented area was covered with a membrane (Geistlich Bio-Gide, Geistlich Pharma) (Fig 2c).

All the patients in the nonpreserved alveolar ridge group also had a connective tissue graft from the palate applied labially below the mucoperiosteal flap and sutured with mattress 4-0 vicryl (Johnson & Johnson Gateway) (Fig 2d). The palate wound was closed with nylon sutures (5-0 Ethilon, Johnson & Johnson), which were removed after 2 weeks. None of the patients with a preserved alveolar ridge received a soft tissue graft.

All implants were uncovered 3 months after placement. During this procedure, an impression was taken to fabricate a screw-retained provisional implant crown. Then, the implants were provided with a healing abutment. A provisional crown was placed (20 Ncm) at the end of the same day. Eccentric and centric contact with antagonist teeth was prevented.
After a 3-month provisional phase, the final open-tray implant-level impression was made (Impregum Penta, 3M ESPE). An individualized zirconia abutment (NobelProcera, Nobel Biocare) was formed according to the digital design of the planned implant crown. The crown was screw- or cement-retained.

Photographic Assessment
Changes in midlabial mucosal level and in approximal mucosal level were assessed from standardized intraoral images (Canon EOS 650D with ring flash) taken one (T1) and 12 (T12) months after placement of the definitive implant crown.

The images were calibrated with a periodontal probe (Williams Color-Coded probe, Hu-Friedy). This probe was placed parallel to and in close contact to the long axis of the neighboring tooth. Full-screen analysis was done with Adobe Photoshop CS5.1 (Adobe Systems). Changes between T1 and T12 were determined by measuring the length of the implant crown.

At T12, the pink esthetic score/white esthetic score (PES/WES) was applied to rate the esthetics of the implant crown and peri-implant mucosa.

Radiographic Assessment
Standardized digital intraoral radiographs were made with an individualized device. On these radiographs, the distance between the first bone-to-implant contact and implant platform was measured to give the marginal bone level at T1 and T12.

Clinical Assessments
At T1 and T12, a single, independent examiner (E.G.Z.) not involved in the implant placement and fabrication of the crown scored: (1) gingival biotype; (2) probing pocket depth; (3) modified Plaque Index; (4) modified sulcus Bleeding Index; (5) Gingival Index; (6) width of keratinized mucosa; (7) approximal papilla volume (papilla index); (8) implant success; and (9) implant survival.

Patient Satisfaction
The patients completed OHIP-14 questionnaires. Overall satisfaction with the current dentition, the treatment procedure, and esthetics were rated on a 10-cm visual analog scale (VAS) at Tpre, T1, and T12. All questions were answered in the absence of the examiner.

Statistical Analysis
Data distribution was analyzed using the Shapiro-Wilk test. Variables that were normally distributed were analyzed with the independent t test. A Mann-Whitney test was applied to non-normally distributed variables. Within-group statistical analysis was done with
Wilcoxon tests. $P < .05$ refers to statistical significance (SPSS Statistics 23.0, SPSS, IBM).

**RESULTS**

Twenty patients received a single implant in a preserved alveolar ridge (test group; 7 men/13 women, mean age 42.0 years), and 20 patients received a single implant in a nonpreserved alveolar ridge (control group; 4 men/16 women, mean age 35.1 years). All the patients’ data were available from all the time points. Table 1 shows the baseline characteristics. The clinical situation before and after treatment is shown in Fig 3. The radiographic situation at T12 is illustrated in Fig 4. Gingival biotype, implant location, and implant diameter did not differ between groups ($P = .44$, $P = .31$, $P = .06$, respectively), while the need for labial augmentation of the implant differed ($P = .00$).

Postoperative healing was uneventful, and no signs of infection were observed during the follow-up. Neither group had lost any implants at T12 (implant survival rate: 100%). All implant success criteria were fulfilled (success rate: 100%).

**Change in Midlabial and Approximal Mucosal Levels**

Whereas the changes in approximal mucosal level between T1 and T12 were comparable (mesial: $P = .20$; distal: $P = .14$; Table 2), the changes in midlabial mucosal level at T12 differed significantly between both groups ($P = .01$; Table 2).

**Change in Marginal Bone Level**

The change in marginal bone level in the test group was $0.03 \pm 0.4$ mm mesially and $0.13 \pm 0.5$ mm distally between T1 and T12. The change in the control group was on average $0.06 \pm 0.5$ mm mesially and

### Table 1  Patient Characteristics and Treatment Specifications Per Group

<table>
<thead>
<tr>
<th>Variable</th>
<th>Test group (n = 20)</th>
<th>Control group (n = 20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male/female</td>
<td>7/13</td>
<td>4/16</td>
</tr>
<tr>
<td>Age (y) mean ± SD (range)</td>
<td>42.0 ± 15.7 (18–71)</td>
<td>35.1 ± 16.2 (18–66)</td>
</tr>
<tr>
<td>Thin/thick biotype</td>
<td>15/5</td>
<td>17/3</td>
</tr>
<tr>
<td>Implant site: I1/I2/C/P1</td>
<td>12/8/0/0</td>
<td>7/12/1/0</td>
</tr>
<tr>
<td>Implant diameter (mm): 3.5/4.3</td>
<td>9/11</td>
<td>15/5</td>
</tr>
<tr>
<td>Bone grafting during implant placement: (Yes/No)</td>
<td>9/11</td>
<td>18/2</td>
</tr>
</tbody>
</table>

![Fig 3](Above (a and b) Test group: (a) failing left central incisor and (b) clinical situation 1 year after placement of the definitive implant crown. (c and d) Control group: (c) failed right central incisor and (d) the clinical situation 1 year after definitive implant crown placement.)

![Fig 4](Right) Standardized radiographs of an implant in the (a) test and (b) control groups taken 1 year after definitive implant crown placement.)
–0.01 ± 0.4 mm distally. The changes were comparable between the groups (P = .55 for the mesial implant side; P = .62 for the distal implant side; Table 2).

Clinical Outcome
At T12, no plaque was detected in any of the patients around the implant crown. The average probing pocket depths at T12 for the test and control groups, respectively, were: 2.9 ± 1.3 mm and 3.0 ± 0.8 mm on the mesial implant side, 3.3 ± 1.1 mm and 3.0 ± 1.1 mm on the distal implant side, 2.9 ± 0.9 mm and 2.7 ± 1.0 mm on the midlabial implant side, and 1.9 ± 0.8 mm and 2.4 ± 0.8 mm on the palatal implant side. A healthy gingiva was observed in all patients except for one patient (test group) with mild inflammation of the gingiva. For details, see Table 3.

Esthetic Assessment
The total PES and separate scoring items of the peri-implant mucosa were comparable between the groups (Table 3). Acceptable peri-implant mucosa esthetic levels (PES ≥ 6) were reached in 70% and in 75% of the control and test groups, respectively.

The esthetics of the implant crown, according to the WES total, were comparable between the groups. Only the item outline and volume of the implant crown had significantly different scores, which is believed to be a coincidence. The implant crown esthetics (WES ≥ 6) were acceptable in 100% of both groups.

Patient Satisfaction
Patient satisfaction according to the VAS scores and total OHIP-14 scores revealed no differences between the groups (Table 4). Satisfaction with the current dental situation (VAS scores) increased significantly in both groups following implant treatment (P = .00 for both groups between Tpre–T1). No further improvement in satisfaction was noted between T1 and T12 (P = .94 [test] and P = .09 [controls], respectively). Satisfaction, according to the total OHIP-14 questionnaire, also improved significantly during the first month after definitive crown placement (P = .00; Table 4), but the obtained gain in satisfaction remained at that level in controls at T12 (P = .07), whereas it improved further in the test group (P = .03).

DISCUSSION
The patients receiving an implant in a preserved alveolar ridge demonstrated only negligible changes in peri-implant soft tissue levels. Although changes in midlabial mucosal levels significantly differed between the control and test groups, the differences were clinically not relevant. Furthermore, the esthetics, clinical peri-implant soft tissue outcomes, and patients’ overall satisfaction were comparable between both groups.

Regarding the minor changes in midlabial mucosal levels and esthetics, according to the total PES score observed in the test group, the results are comparable to those of other studies. Patients in the control group also demonstrated limited changes in midlabial mucosal levels, which are comparable to the results of a case series study. To the best of the authors’ knowledge, it is the only study of the change in midlabial mucosal level upon implant placement in a nonpreserved alveolar ridge with connective tissue grafting. Although, in the present study, a difference was observed in midlabial mucosal level changes between both groups, in favor of the control group, the mean changes, namely, −0.15 mm (test group) and 0.07 mm (control group), were minor and well within esthetically acceptable changes of 0.5 mm and can therefore be judged as clinically insignificant. The authors would like to hypothesize that it is generally irrelevant whether the bone augmentation procedure is done...
### Table 3  
Clinical Outcome Measures and Changes in Esthetics 12 Months (T12) After Definitive Crown Placement

<table>
<thead>
<tr>
<th>Variable</th>
<th>Test group (n = 20)</th>
<th>Control group (n = 20)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PES total (max 10; mean ± SD)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mesial papilla</td>
<td>1.50 ± 0.51</td>
<td>1.40 ± 0.50</td>
<td>.53</td>
</tr>
<tr>
<td>Distal papilla</td>
<td>1.35 ± 0.49</td>
<td>1.45 ± 0.51</td>
<td>.52</td>
</tr>
<tr>
<td>Curvature of facial mucosa</td>
<td>1.40 ± 0.60</td>
<td>1.55 ± 0.51</td>
<td>.45</td>
</tr>
<tr>
<td>Level of facial mucosa</td>
<td>1.25 ± 0.79</td>
<td>0.90 ± 0.85</td>
<td>.19</td>
</tr>
<tr>
<td>Root convexity/soft tissue color and texture</td>
<td>1.05 ± 0.76</td>
<td>1.30 ± 0.57</td>
<td>.29</td>
</tr>
<tr>
<td><strong>WES total (max 10; mean ± SD)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tooth form</td>
<td>1.80 ± 0.41</td>
<td>1.50 ± 0.51</td>
<td>.05</td>
</tr>
<tr>
<td>Outline/volume</td>
<td>1.95 ± 0.22</td>
<td>1.55 ± 0.51</td>
<td>.00</td>
</tr>
<tr>
<td>Color (hue/value)</td>
<td>1.70 ± 0.47</td>
<td>1.75 ± 0.44</td>
<td>.73</td>
</tr>
<tr>
<td>Surface texture</td>
<td>1.70 ± 0.47</td>
<td>1.65 ± 0.49</td>
<td>.74</td>
</tr>
<tr>
<td>Translucency/characterization</td>
<td>1.55 ± 0.51</td>
<td>1.55 ± 0.51</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>PES/WES total (max 20; mean ± SD)</strong></td>
<td>8.70 ± 0.92</td>
<td>8.00 ± 1.21</td>
<td>.06</td>
</tr>
<tr>
<td><strong>Bleeding upon probing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No bleeding</td>
<td>55%</td>
<td>40%</td>
<td>N/A</td>
</tr>
<tr>
<td>Isolated bleeding</td>
<td>30%</td>
<td>45%</td>
<td></td>
</tr>
<tr>
<td>Confluent red line</td>
<td>15%</td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td><strong>Papilla volume</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mesial/distal of implant</td>
<td>0%/0%</td>
<td>0%/0%</td>
<td>N/A</td>
</tr>
<tr>
<td>&lt; half papilla</td>
<td>0%/0%</td>
<td>0%/0%</td>
<td></td>
</tr>
<tr>
<td>≥ at least half papilla</td>
<td>45%/55%</td>
<td>30%/45%</td>
<td></td>
</tr>
<tr>
<td>Entire papilla</td>
<td>55%/45%</td>
<td>70%/55%</td>
<td></td>
</tr>
<tr>
<td>Hyperplastic papilla</td>
<td>0%/0%</td>
<td>0%/0%</td>
<td></td>
</tr>
<tr>
<td><strong>Keratinized mucosa width</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 2 mm</td>
<td>90%</td>
<td>85%</td>
<td>N/A</td>
</tr>
<tr>
<td>1–2 mm</td>
<td>5%</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>&lt; 1 mm</td>
<td>0%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>0 mm</td>
<td>5%</td>
<td>10%</td>
<td></td>
</tr>
</tbody>
</table>

N/A = not applicable.

### Table 4  
Patient Satisfaction Regarding General Satisfaction, Esthetics, and Treatment Procedure Before Treatment (Tpre) and 1 (T1) and 12 (T12) Months After Definitive Crown Placement

<table>
<thead>
<tr>
<th>VAS questions (0–10)</th>
<th>Test group (n = 20)</th>
<th>Control group (n = 20)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfaction with current dental situation</td>
<td>5.8 (3.6–6.3)</td>
<td>5.4 (4.1–6.4)</td>
<td>.85</td>
</tr>
<tr>
<td>Satisfaction with current dental situation compared to situation before treatment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfaction with implant and implant crown</td>
<td>0.1 (0.0–0.3)</td>
<td>9.6 (8.2–10.0)</td>
<td></td>
</tr>
</tbody>
</table>

**Esthetics (0–10)**
- Color of the crown
- Form of the crown
- Color of the peri-implant mucosa
- Form of the peri-implant mucosa

**Treatment procedure (0–10)**
- Patient regrets that treatment was chosen
- Patient would recommend treatment to other patients

**Total OHIP score (0–70)**
- 24.5 (21.3–41.0)
- 27.5 (22.3–33.5)

*P < .00 within-group comparison.
immediately after tooth removal, before or with implant placement, and whether it is done concomitantly with a connective tissue graft, as done in this study. However, other than covering the socket with a soft tissue graft immediately after tooth removal, bone augmentation surgery is beneficial for preservation of the contour of the labial bone and soft tissue and reduces the further need to re-augment the labial bone wall, which was also demonstrated in this study. Major labial bone wall defect cases following tooth extraction, which heal unassisted, often need an extensive bone augmentation procedure with autologous bone in a separate surgical procedure before an implant can be inserted. Such treatment is long and arduous and could be shortened by augmenting the extraction socket immediately after extraction because it preserves the alveolar ridge, and implant placement can be done 4 months thereafter. This is in accordance with the literature.

Furthermore, based on the comparable esthetics results and the clinically irrelevant differences in midlabial mucosal level changes between the groups, the application of a soft tissue graft to seal the extraction socket in the test group, which was suggested to be advantageous in maintaining the labial soft tissue contour, seems to have a comparable effect to the application of a connective tissue graft in the control group. Possibly, therefore, no further grafting of soft tissue is necessary at placement of the implant.

This cohort study has limitations with regard to the study design and the short follow-up period of 1 year. It would have been better to investigate the effect of preservation of the alveolar ridge in a randomized controlled clinical trial (RCT). In the authors’ opinion, a RCT is ethically unjustifiable in patients with a single failing tooth because they would then deliberately not receive an alveolar ridge preservation and hence preservation of the midlabial mucosal level.

Most studies investigating the effect of connective tissue grafting focused on the change in midlabial mucosal volume. Both Stefanini et al, in a case series study, and Hanser and Khoury, in a consecutive clinical study, observed a significant thickening of the midlabial mucosa on applying a connective tissue graft at implant placement in a nonpreserved alveolar ridge. Wiesner et al, in an investigation of the effect of connective tissue grafting compared with no grafting in a split-mouth study in the (pre)molar area, also observed a significant thickening of the midlabial mucosa accompanied by a better esthetic outcome, according to a significantly better PES when placing an implant in a nonpreserved alveolar ridge concomitantly with a connective tissue graft. These outcomes are in contrast to the results of the present study. Although a significant difference was noted in the change in midlabial mucosal level, a difference could not be found in the PES between the groups, which can possibly be explained by the comparable effect of the insertion of a soft tissue graft in a preserved alveolar ridge (test group) to seal
the socket after bone augmentation and in a nonpreserved alveolar ridge (control group) to graft the labial soft tissue contour at implant placement. Although grafting of the soft tissue at implant placement in a nonpreserved alveolar ridge is presumed to be beneficial, it might be possible that not grafting the labial soft tissue contour is also an option, but this needs further investigation.

The only aspect focusing on the change in midlabial mucosal volume in the present study is the last PES item, which assesses the root convexity combined with soft tissue texture and color. A difference between the groups was not observed, but on average this item did not score very high in the groups, suggesting that at least one aspect is deficient in all the patients compared with the contralateral tooth. It might be that the midlabial mucosal volume, according to this PES item, when compared with the midlabial mucosal volume of the contralateral tooth in both groups, is less beneficial. However, PES scoring has limitations, since it combines three aspects of the midlabial mucosa in one score. It only makes statements about whether all aspects of this item (score 2), two aspects of this item (score 1), or only one or no aspects of this item (score 0) are similar to the contralateral tooth, without being specific about which aspect is deficient compared with the contralateral tooth.

Most of the patients in the control and test groups had, preoperatively, a thin gingival biotype. Such a biotype might reflect a thin labial bone wall, hence, resorption of the labial bone wall could be more pronounced in such a patient. This could result in a less beneficial esthetic outcome with respect to the midlabial mucosal level due to deficient support of the compromised labial bone wall. The clinical outcomes of the midlabial mucosal level and the general esthetics of this study, however, were good, implying that the association between gingival biotype and labial bone wall thickness is limited. This is in line with La Rocca et al, who did not observe any correlation between labial bone wall thickness and gingival biotype. Additionally, a recent RCT on conventional implant treatment by the present study group could not find a correlation between the change in midlabial mucosal level and gingival biotype.

Marginal bone level changes were comparable between the test and control groups and in line with other studies. This may be because both bone augmentation procedures resulted in a comparable stable bone level between 1 month and 1 year after placement of the definitive crown.

Future studies investigating the effect of grafting of the soft tissue simultaneously with placement of the implant should focus more on the change in midlabial mucosal level, since a 0.5-mm recession can have a disturbing effect on the esthetic outcome and is underexposed in the available literature.

**CONCLUSIONS**

Rehabilitation of single failing teeth with single implants placed in preserved alveolar ridges or of single missing teeth with treatment with a single implant in a nonpreserved alveolar ridge accompanied with connective tissue grafting results in nonrelevant clinical changes in midlabial mucosal level and good esthetic and clinical outcomes.

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