The term “periodontal plastic surgery” was introduced in the late 1980s and consists of a broad range of procedures aiming at correcting or eliminating anatomic, developmental, or traumatic deformities of the gingiva or alveolar mucosa.

One of the major esthetic challenges in periodontal plastic surgery is related to the ability of rebuilding lost papillae in the maxillary anterior segment. The presence of such interproximal space results in esthetic and phonetic problems.

Interdental papillae can be lost as a result of several distinct clinical situations. The first is the presence of a naturally occurring midline diastema. This situation can be remedied with orthodontic treatment, positioning the teeth closer together. Diverging roots is another situation that can result in the presence of an interproximal space when the contact point between the two clinical crowns is situated too incisally. Orthodontics may also correct such a clinical situation by aligning the roots and “squeezing” the interproximal soft tissue, thereby creating a new papilla. A clinical crown that...
tends to be triangular in shape can also result in a partial interproximal space. This happens because of an accentuated discrepancy in the mesiodistal width at the incisal edge and gingival line. Reshaping the clinical crowns is helpful in reducing the interproximal opening.

True loss of a previously existing interdental papilla can occur as a result of periodontal disease processes or as a result of periodontal surgical procedures. Tarnow et al\(^8\) suggest that partial loss of the soft tissue might occur with surgical reflection of the interproximal tissue in areas in which the distance between the contact point and the crest of the interdental bone is > 5 mm. Therefore, it is not unusual for the clinician to encounter situations where reconstruction of a lost papilla is desirable. Unfortunately, while orthodontics and restorative dentistry are effective in improving the clinical situation, predictable surgical reconstruction of a lost papilla is not a reality yet.

Surgical techniques aiming at correcting the “black hole problem” have been used mainly with free epithelialized gingival grafts, repeated interproximal curettage, or displacement of the interproximal palatal tissue in the buccal direction.\(^9,10\) While limited success has been achieved with these procedures, the major limiting factor for the complete and predictable survival of the graft tissues is the lack of a minimal source of blood supply.\(^11\)

The healing principles on which the subepithelial connective tissue graft for root coverage\(^12,13\) and ridge augmentation\(^14\) are based (double blood supply) have been applied to the reconstruction of the interdental papilla, thus increasing both the success rate and predictability.\(^15\)

The purpose of this article is to describe a case of complete papilla reconstruction using a technique involving an interposed palatal connective tissue graft, and to discuss the factors that may influence the final result.

**Case report**

A healthy 20-year-old nonsmoking woman was referred to the author for the reconstruction of the lost interdental papilla between the maxillary left central and lateral incisors (Figs 1 and 2). The patient reported to
have undergone two surgical procedures involving guided tissue regeneration (GTR) of the area with limited success. Her complaints were of an esthetic and phonetic nature. Clinical examination revealed a high smile line,\textsuperscript{16} Class IV gingival recession on the buccal aspects of the maxillary left central and lateral incisors,\textsuperscript{17} and a Class III\textsuperscript{18} papillary loss between these teeth, with complete destruction in the buccal/palatal direction. The soft tissues presented a healthy clinical aspect with a minimal sulcus depth, and the initial therapy consisted of just oral hygiene instructions.

The initial clinical measurements are shown in Table 1. Basically, the left central and lateral incisors presented a 2.0-mm recession on the straight buccal surfaces, with a sulcus depth not exceeding 3.0 mm. There was a 5.5-mm interproximal distance from the contact point to the soft tissue surface, and a 4.0-mm distance from the gingival margin to the bone. There was a 3.5-mm width measured in the interproximal space at the level of the existing gingival tissue, and 6.0 mm of keratinized tissue was measured from the gingival margin to the mucogingival junction (Fig 3).

**Surgical technique**

Following phase one therapy, the gingival tissue around the maxillary left central and lateral incisors was clinically healthy. Since extensive root planing had been performed as part of the previous regenerative procedures, only light mechanical root instrumentation was performed before the surgery, and no chemical root conditioning was used.

After the administration of local anesthesia, a split-thickness semilunar incision\textsuperscript{19} was performed 2 mm coronal to the mucogingival junction, extending from the mesial aspect of the central incisor to the distal aspect of the lateral incisor. Intrasulcular incisions were then made with a No. 15C blade around the necks of these teeth, extending from the buccal face to the palate. The existing papilla was fully preserved (Fig 4). Immediately after this procedure, the donor tissue, consisting of 2-mm-thick palatal connective tissue, was harvested from the premolar.\textsuperscript{20} It was then shaped to fit the interproximal area and preserved in saline gauze.

To release the gingivopapillary unit from the bone, a split-thickness flap was initiated using an Orban knife through the semilunar incision on the buccal face, extending toward the palate (Fig 5). It is

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Baseline</th>
<th>Final</th>
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</thead>
<tbody>
<tr>
<td>Keratinized gingiva</td>
<td>6.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Distance from contact point to bone crest</td>
<td>9.5</td>
<td>9.5</td>
</tr>
<tr>
<td>Distance from contact point to gingival margin</td>
<td>5.5</td>
<td>0.0</td>
</tr>
<tr>
<td>Horizontal component measured at line angle of adjacent teeth at gingival margin level</td>
<td>3.5</td>
<td>0.0</td>
</tr>
<tr>
<td>Facial recession (central incisor)</td>
<td>2.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Facial recession (lateral incisor)</td>
<td>2.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

\textbf{Fig 3} Preoperative measurements. A = facial recession of maxillary left central incisor; B = facial recession of lateral incisor; C = distance from contact point to gingival margin; D = horizontal distance between roots; E = distance from contact point to bone crest.
important to note that care must be exercised to avoid perforating the palatal tissue or damaging the interproximal papilla. After the incisions, the soft tissue was completely released from the root and bone, and the whole flap became mobile, allowing for the coronal displacement of the papillary unit. A buccal/palatal void (dead space) could be seen between the soft tissue and the bone structure (Fig 6). To maintain the whole unit coronally, the dead space was filled with the connective tissue graft (Fig 7). It was introduced and stabilized in place using a palate-graft-palate suture. The alveolar mucosa was then dissected to promote its coronal advancement without any tension over the papillary structure. Suturing of the semilunar incision was initiated (Fig 8), and primary closure was obtained with healing by first intention. No periodontal dressing was used, nor was antibiotic therapy recommended. The postoperative care consisted of 0.12% chlorhexidine rinses 3 times a day for 4
weeks, with no mechanical cleaning of the interproximal area. Flossing was initiated at the beginning of the ninth postoperative week.

Two other surgical procedures with identical protocols were performed in the same area at 8-week intervals (Fig 9).

Follow-up

Healing following all three surgical procedures was uneventful (Fig 10). Four years after the surgical procedures, the interproximal space was still completely filled, and the height and volume of the reconstructed papilla had been maintained. The previously existing buccal recessions on both teeth were covered, and the sulcus depth around the maxillary left central and lateral incisors did not exceed 2.5 mm (Fig 11). The keratinized tissue increased to 9.0 mm, and the bone crest remained at the same baseline level (Fig 12). It is important to mention that the clinical results obtained after the first 8 postoperative weeks were the same as those noted 4 years after the last surgery. Therefore, in this case, 8 postoperative weeks reflected the long-lasting result.

Discussion

One of the most undesirable effects of any periodontal surgical technique involving interproximal areas is marginal tissue recession and loss of papillary tissue. This loss can occur mainly because of blood supply discontinuation caused by the incision made in the papillary area. GTR procedures in interproximal areas may compromise blood supply because of the lack of direct contact between the flap and underlying bone.
Therefore, complete collapse of the interdental papilla might occur.\textsuperscript{21–25} Since proper root angulations and proportional size of the crowns were present, there was no need of orthodontic movement or reshaping the dental crowns. The only alternative left to improve the defect found between the maxillary left central and lateral incisors was surgical reconstruction of the papilla.

As a result of significant tooth structure removal through extensive scaling and root planing during the previous GTR procedures, an even larger interproximal area had to be filled. This may explain why multiple surgeries were required. A positive aspect of having a larger interproximal area is that it provides a better source of blood supply from the flap to the graft. Both the maximized blood supply and maintenance of papillary integrity by the flap design were essential in avoiding flap necrosis and enhancing the grafted tissue “take.” Harvesting of the graft was performed just before the surgical detachment of the papilla to prevent the development of a blood clot between the bone and grafted connective tissue. Blood clots, even small ones, might compromise immediate blood supply to the graft and therefore induce partial necrosis of the transplanted tissue.

Once the distance from the contact point to the gingival margin was larger than the buccal marginal recession, the repeated treatment in this area using the same flap design resulted in excessive coronal migration of the gingival margin on the straight buccal surfaces of the central and lateral incisors. A simple gingivoplasty was performed to relocate the gingival margin to the level of the cementoenamel junction (CEJ).

**Conclusions**

This case has shown that the surgical technique using an interposed subepithelial connective tissue graft can regenerate a lost interdental papilla. The reconstructed papilla remained stable and without any signs of clinical inflammation 4 years after the surgery. Clinical studies using large sample sizes are necessary to determine the success rate and predictability of this surgical technique.

- The interposed subepithelial connective tissue graft technique can regenerate a lost interdental papilla.
- To be successful, the surgical technique must involve the maintenance of the integrity of the interproximal tissue.
- Multiple surgical procedures may be required.

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References