New Surgical Protocol to Create Interimplant Papilla: The Preliminary Results of a Case Series

Article · February 2016
DOI: 10.11607/prd.2603

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New Surgical Protocol to Create Interimplant Papilla: The Preliminary Results of a Case Series

Stuart Froum, DDS1
Miltiadis Lagoudis, DMD2
Giovanni Molina Rojas, DDS3
Takanori Suzuki, DDS, PhD4
Sang-Choon Cho, DDS5

The aim of this study was to introduce a new surgical technique to regenerate the papilla adjacent to multiple or single implants using a novel instrument and a new incision design. A total of 10 consecutively treated patients with maxillary anterior implant-supported provisional restorations and missing interproximal papillae received a subepithelial connective tissue graft. The recipient site was prepared with a buccal incision apical to the mucogingival junction and to the defective papilla, and a palatal incision, followed by buccolingual tunneling performed with a translingual curette (EBINA). A total of 10 sites were treated and evaluated pre- and postoperatively with the papilla score based on the Jemt classification. The final prosthesis was delivered 3 months after the papilla regeneration surgical procedure. An average improvement in papilla index score from 0.8 to 2.4 was found after an average follow-up period of 16.3 months. This case series demonstrated that interimplant papilla regeneration can be successful over a period of 11 to 30 months postloading. Long-term prospective studies on tissue stability and esthetic outcomes are needed to corroborate the findings in this study. Int J Periodontics Restorative Dent 2016;36:161–168. doi: 10.11607/prd.2603

Replacing missing teeth with dental implants has become a viable solution for conventional fixed or removable prosthodontics. However, the application of the principles of osseointegration to single missing teeth and partial edentulism has increased patient esthetic demands. An important aspect of the success criteria for dental implants in the esthetic zone involves the establishment of soft tissue contour with an intact interdental papilla and a gingival outline that is harmonious with the gingival silhouette of the adjacent healthy dentition.

Lack of interdental papilla can lead to cosmetic deformities, phonetic difficulties, and food impaction. The vertical distance from the crest of the bone to the height of the interproximal papilla between adjacent implants, between implant and natural tooth, and between implant and pontic has been measured and reported. When this distance was 5 mm or less between two adjacent teeth, the papilla completely filled this space approximately 100% of the time. In cases where an implant was adjacent to a natural tooth, the average height was reported to be 4.5 mm. However, the average height of tissue over the crest of bone between two adjacent implants was reported to be 3.4 mm. Thus, in cases of

1Clinical Professor and Director of Clinical Research, Ashman Department of Periodontology and Implant Dentistry, New York University College of Dentistry, New York, New York, USA.
2Implant Resident, Ashman Department of Periodontology and Implant Dentistry, New York University College of Dentistry, New York, New York, USA.
3Former Implant Resident, Ashman Department of Periodontology and Implant Dentistry, New York University College of Dentistry, New York, New York, USA.
4Clinical Assistant Professor of Advanced Program for International Dentists in Implant Dentistry, Ashman Department of Periodontology and Implant Dentistry, New York University College of Dentistry, New York, New York, USA.
5Clinical Assistant Professor and Director of Advanced Program for International Dentists in Implant Dentistry and Co-Director of Clinical Research, Ashman Department of Periodontology and Implant Dentistry, New York University College of Dentistry, New York, New York, USA.

Correspondence to: Dr Stuart Froum, 17 W 54th Street, Suite 1C/D, New York, NY 10019, USA. Fax: 212-246-7599. Email: dr.froum@verizon.net

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two adjacent anterior implants, deficient interimplant papillae often occur.

Numerous methods have been proposed to regenerate papilla. However, due to compromised blood supply and scar tissue formation, these techniques were reported to be unpredictable. Villareal et al in 2010 described a predictable approach for papilla regeneration using careful and gentle soft tissue manipulation during surgery. The protocol included papilla-sparing incisions and minimal reflection of the flap. The underlying concept was to preserve the blood supply to the adjacent papilla and soft tissue and maintain soft tissue quality. For this reason, it was suggested that sutures through or close to the papilla should be avoided as they can cause trauma and inflammation, negatively affecting the outcome of the papilla regeneration procedure.

The purpose of the present case series was to introduce a new surgical technique to regenerate the papilla adjacent to multiple or single implants during the provisionalization stage, and to report the clinical results.

### Materials and methods

The clinical data in this study was extracted as deidentified information from the implant database ID from the routine treatment of patients at the Ashman Department of Periodontology and Implant Dentistry at the New York University College of Dentistry Kriser Dental Center. The Office of Quality Assurance at the New York University College of Dentistry certified the ID. This study is in compliance with the Health Insurance Portability and Accountability Act requirements and approved by the University Committee on Activities Involving Human Subjects.

### Study subjects

Ten consecutively treated cases from the implant database that required treatment with multiple or single maxillary anterior implants were included in this study. Patients that presented with implant-supported provisional crowns or bridges and who had undergone the papilla regeneration procedure between August 2011 and August 2012 were included in this retrospective case series. The subjects were 3 males and 7 females (average age: 45 years). The treatment sites were papillae between adjacent implants, between an implant and an adjacent natural tooth, and between an implant and an adjacent pontic site, from position 13 to 23 (canine to canine).

### Measurements

Following provisional placement, measurements were made interproximally from the contact point of the treatment site, vertically to the crestal gingiva. Measurements were made independently by two calibrated investigators to ensure accuracy.

### Table 1 | Classification of interproximal papilla

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No papilla is present</td>
</tr>
<tr>
<td>1</td>
<td>Less than half of the height of the papilla is present</td>
</tr>
<tr>
<td>2</td>
<td>Half or more of the height of the papilla is present</td>
</tr>
<tr>
<td>3</td>
<td>The papilla fills up the entire proximal space</td>
</tr>
<tr>
<td>4</td>
<td>The papillae are hyperplastic</td>
</tr>
</tbody>
</table>

The inclusion criteria were as follows:

1. Presence of an implant-supported provisional restoration
2. Absence of interproximal papilla, Jemt classification 0 to 1
3. Missing papilla in anterior maxilla, between adjacent implants, between an implant and an adjacent natural tooth, or between an implant and an adjacent pontic site

The exclusion criteria were as follows:

1. Pregnant or lactating
2. Active periodontal disease in the remaining dentition
3. Systemic diseases or medications that could alter the tissue healing around dental implants
4. Unwillingness to commit to a long-term post-therapy maintenance program
In no case did the investigators differ in their opinion of the 0 or 1 classification. At each recall visit following placement of the final restoration, the same two investigators measured and classified the papillae.

**Surgical procedure**

Preoperative antibiotics were given orally 1 hour prior to surgery (amoxicillin 2 g, or clindamycin 600 mg, for patients allergic to penicillin). Following the administration of local anesthesia (lidocaine with epinephrine 1:100,000, Henry Schein), the provisional restoration was removed and the embrasure space at the site of the planned papillary augmentation was opened. Sufficient interproximal embrasure widening was performed prior to surgery to achieve an esthetically acceptable restoration with adequate papilla volume (Fig 1a). Prior to modification of the provisional restoration, the papilla in the deficient site was indexed using the Jemt classification. The provisional restoration was removed and a full-thickness oblique incision was made in the vestibular mucosa, apical to the deficient papilla area (Fig 1b). Another full-thickness oblique incision was made on the palatal side (Fig 1c). The incisions were made in an oblique direction from distal to mesial at a distance from the papilla to preserve the blood supply of the mucosa at the recipient site. The translingual curette (TLC) (EBINA), a modified and twice angulated curette (Fig 1d), provided access to the tunnel apically and easy access to the interproximal area without causing any damage to the tissue. It was gently inserted into the buccal incision, elevating...
the periosteum or flap, and used to create a subperiosteal tunnel toward the crest of the ridge, coronally to the interproximal area (Fig 2). Care was taken to avoid excessive elevation, keeping the dissection limited to the defect size. The same elevation was performed on the palatal side, creating a tunnel between the buccal and lingual incisions.

Following local anesthesia, a subepithelial connective tissue graft was harvested from the palate according to the Langer and Calagna and the Hürzeler and Weng techniques, and the donor site was sutured with 4/0 chromic gut sutures (Ethicon). Two 4/0 chromic gut sutures were placed at the mesial and distal margins of the subepithelial connective tissue graft to facilitate the insertion and stabilization of the graft over the defect (Fig 3). The graft was inserted into the recipient site through the buccal incision and pulled under the papillae through the lingual incision (Fig 4). Once the graft was correctly positioned over the interproximal papilla area, the resorbable 4/0 chromic gut sutures placed at the mesial and distal margins of the connective tissue graft were used to secure it in position and then close the buccal and lingual entry incisions (Fig 5). The postoperative protocol consisted of antibiotics, amoxicillin 500 mg or clindamycin 150 mg three or four times a day, respectively, for 1 week, and analgesics (ibuprofen 600 mg every 4 to 6 hours). The patient was also instructed to use 0.12% chlorhexidine rinses twice a day starting 24 hours after surgery for 2 weeks. Postoperative care instructions, including a soft diet and oral hygiene procedures, were given to the patient. The patient was told to avoid brushing and flossing in the surgical area and to use rinses of 0.9% saline 5 to 6 times a day and chlorhexidine twice a day only. A follow-up examination was performed 7 to 14 days postoperatively (Fig 6). After a healing period of 3 months, the final restoration was delivered (Figs 7a to 7d). The final restoration was carefully designed following the exact interproximal contour of the provisional. In sites where the papilla was created but did not fully fill the interproximal area, a slight elongation of the contact point was made in the final restoration. All patients were recalled every 3 months following final restorations for follow-up examinations and periapical radiographs. The papilla
height was again measured by the same two investigators and recorded using the Jemt papilla classification during each recall.

In another case, a 55-year-old Asian woman presented with a chief...
complaint of “black space between her implants” (Fig 8a). She presented with two restored and splinted implants in the left central and lateral areas. The papilla was classified as Jemt class 0. The same papilla regeneration procedure as described previously was performed. Twelve months postsurgery the papillae completely filled the space (Jemt: 3) and a new two-unit restoration was fabricated (Figs 8b and 8c).

**Results**

The results of the present case series are summarized in Table 2. The 10 reported cases were followed for an average period of 16.3 months (range: 11 to 30 months), with an average improvement of Jemt papilla score from 0.8 to 2.4 (range: 0 to 3). In only one case was no improvement observed.

**Discussion**

Several surgical methods have been advocated for papilla regeneration. Palacci et al suggested a full-thickness flap elevation from the buccal and palatal sides of the ridge and 90-degree rotation to fill the interproximal space adjacent to an implant.10 Adriaenssens et al introduced the “palatal sliding strip flap” to form papillae between implants.

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**Table 2** Results of the technique for the 10 patients included in the study

<table>
<thead>
<tr>
<th>Subject</th>
<th>Interproximal papillae sites*</th>
<th>Implant/pontic/tooth</th>
<th>Abutment</th>
<th>Starting score (Jemt classification)</th>
<th>Ending score (Jemt classification)</th>
<th>Duration (mo)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12, 11</td>
<td>I-I</td>
<td>Titanium</td>
<td>1</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>12, 11</td>
<td>I-T</td>
<td>Titanium</td>
<td>1</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>11, 21</td>
<td>I-I</td>
<td>Titanium</td>
<td>0</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>11, 21</td>
<td>I-P</td>
<td>Titanium</td>
<td>1</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>21, 22</td>
<td>P-I</td>
<td>Titanium</td>
<td>1</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>21, 22</td>
<td>I-I</td>
<td>Zirconia</td>
<td>0</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>7</td>
<td>12, 11</td>
<td>I-P</td>
<td>Titanium</td>
<td>1</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>8</td>
<td>12, 11</td>
<td>I-P</td>
<td>Titanium</td>
<td>1</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>9</td>
<td>21, 22</td>
<td>I-I</td>
<td>Zirconia</td>
<td>1</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>10</td>
<td>21, 22</td>
<td>I-I</td>
<td>Titanium</td>
<td>1</td>
<td>2</td>
<td>30</td>
</tr>
</tbody>
</table>

Mean: 0.8 Mean: 2.4 Mean: 16.3

*FDI tooth numbering system. I = implant; P = pontic; T = tooth.
and natural teeth in the anterior area of the maxilla. This technique includes sliding the palatal mucosa in a labial direction.\textsuperscript{12} Nemcovsky et al used a U-shaped incision.\textsuperscript{14} Arnoux et al described several tissue augmentation techniques at stage 1 and stage 2 surgery to enhance single tooth esthetics.\textsuperscript{15} The reported surgical procedures were not predictable due to the limited blood supply and presence of scar tissue as a result of surgical trauma.\textsuperscript{21–23}

Chao presented the pinhole surgical technique (PST) as a root coverage procedure. The PST required no releasing incision, sharp dissection, or suturing. Similar to the technique presented in this article, it was proposed as a minimally invasive procedure with the main difference being that PST uses one vestibular incision, using a bioresorbable membrane (BM) (Bio-Gide, Geistlich) or acellular dermal matrix (ADM) (AlloDerm, BioHorizons) and was described for root coverage. However, this technique did not address or result in any improvement in the interproximal papilla.\textsuperscript{24}

The present study presents a technique to improve the predictability of papilla regeneration procedures, achieving an average increase in Jemt papilla score from 0.8 to 2.4. This technique can be successfully used for papillae between implants and teeth, between two adjacent implants, and between implants and pontic sites. According to the results of the present study, papilla regeneration between an implant and a tooth is more predictable than regeneration between two adjacent implants. To the present authors’ knowledge, this is the first study showing a predictable result for papilla regeneration.

The need for adequate instrumentation to achieve the elevation of the mucoperiosteal tunnel from a remote incision and to minimize the chance of perforation led to the development of the TLC. This instrument allows for a full-thickness reflection minimizing the risk of soft tissue perforation due to its anatomical design. The TLC facilitated the soft tissue tunnel preparation, increasing the predictability of the regenerative procedure (Figs 1d and 2). Although 6 of the 10 treated areas resulted in complete papilla regeneration, the improvement in 3 of the 4 other cases was either accepted by the patient or allowed slight elongation of the contact point of the final restoration. This resulted in patient satisfaction with the esthetic result in all 3 cases. The one case that failed to show any gain was retreated and is currently in the healing phase.

Although further studies are needed to confirm the stability of the soft tissue after papilla regeneration, this study suggests that the technique proposed has the ability to predictably improve and in most cases achieve papilla integrity between implants, between implant and tooth, and between implant and pontic in the esthetic zone.

**Conclusion**

Within the limitations of this case series, the present results show an average improvement in papilla index of 1.6 (Jemt classification) with a range of 0.8 to 2.4 in esthetic areas between two adjacent implants, between implant and tooth, and between implant and pontic site. The papilla regeneration was achieved with carefully planned incision design, atraumatic tissue handling, minimal tension during suturing, and meticulous home care after surgery. Further studies with more cases and longer follow-ups are required to establish the long-term effectiveness of this regenerative technique.

**Acknowledgments**

Dr Cho has a patent pending (no. PCT/KR2014/007855), for Trans-Lingual Curette (TLC).

**References**


