Treatment Concepts
for Periodontal Regenerative Surgery
Why periodontal regeneration?

Helping patients affected by periodontitis to create and maintain good oral health, function, and aesthetics is the goal of every dentist. To accomplish this, various therapeutic approaches have been developed in response to the grades of severity of periodontitis. The role of biomaterials in treating periodontal disease has gained importance and is now an integral part of many protocols. Carefully selected biomaterials used with proven treatment protocols may not only stop progression of periodontal disease, but effectively regenerate both hard and soft tissue.1,2

TooTH preserva Tion or implanT?

Teeth will last for life, unless they are affected by oral diseases or service interventions. Many retained teeth therefore may be an indicator of positive oral health behaviour throughout the life course. Tooth longevity is largely dependent on the health status of the periodontium, the pulp or periapical region and the extent of reconstructions.3 Multiple risks lead to a critical appraisal of the value of a tooth. Choosing between periodontal regeneration to support tooth preservation and tooth extraction has been called one of the most complex and debatable decisions a dentist is confronted with in daily clinical practice.4

Assigning a questionable prognosis – where the tooth requires advanced treatment to maybe preserve it – or a hopeless prognosis, where the tooth needs to be extracted as soon as possible, is often a delicate situation. This decision significantly impacts both treatment planning and patient lifestyle. Accordingly, it has been argued that periodontally compromised teeth should be treated for as long as possible, and only being extracted when periodontal and endodontic treatment is no longer possible.4, 5

Regardless of whether the tooth is preserved or extracted, biomaterials are often required to reach the individual therapeutic goals. Some criteria to categorise the prognosis of periodontally affected teeth are summarised in Table 1.6-8

### Table 1. Prognosis of periodontally affected teeth: For classification at least one of the parameters (respectively two for hopeless teeth) has to be met.6-8

<table>
<thead>
<tr>
<th>GOOD</th>
<th>QUESTIONABLE</th>
<th>HOPELESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>teeth with &lt; 50% bone loss</td>
<td>teeth with 50-75% bone loss or &gt; 6-8 mm PD or class 2 furcation or angular defect</td>
<td>teeth with &gt; 75% bone loss or more than 8mm PD or Class 3 furcation or Class 3 mobility or teeth with at least 2 characteristics of questionable category</td>
</tr>
</tbody>
</table>

**TOOTH PRESERVATION OR IMPLANT?**

Teeth will last for life, unless they are affected by oral diseases or service interventions. Many retained teeth therefore may be an indicator of positive oral health behaviour throughout the life course. Tooth longevity is largely dependent on the health status of the periodontium, the pulp or periapical region and the extent of reconstructions.3 Multiple risks lead to a critical appraisal of the value of a tooth. Choosing between periodontal regeneration to support tooth preservation and tooth extraction has been called one of the most complex and debatable decisions a dentist is confronted with in daily clinical practice.4

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Regardless of whether the tooth is preserved or extracted, biomaterials are often required to reach the individual therapeutic goals. Some criteria to categorise the prognosis of periodontally affected teeth are summarised in Table 1.6-8
Regenerative therapy: getting to the root of the problem

Good – Questionable – Hopeless . . . now what?

In advance of any regenerative therapy, an initial nonsurgical hygienic phase is crucial. This may include patient education on oral hygiene, scaling and root planing, antibacterial therapy, and removal of plaque retentive factors – all aimed to yield a good tissue response by eliminating infection and alleviating inflammation. When these methods fail to prevent bone loss, surgical or even regenerative therapy for periodontally compromised teeth is the recommended next-line therapy (Figure 2).

Moreover, periodontally compromised but treated teeth are known to have survival rates equal to the survival rates of implants in well-maintained patients. A growing amount of evidence indicates that periodontal regeneration can result in long-term retention of teeth originally presenting with deep pockets associated with intra-bony defects. A randomised, long-term clinical trial in 50 patients comparing periodontal regeneration with extraction and prosthetic replacement of hopeless teeth showed that regenerative therapy enabled retention of 92% “hopeless” teeth scheduled for extraction.

The retained teeth had clinically stable periodontal parameters, comfort and function for the follow-up period of 5-years (Figure 1).

AIMS OF REGENERATIVE TREATMENT

- Restoration of the complete tooth attachment apparatus with bone, cementum, and ligament
- Prevention of long junctional epithelial down growth as a risk factor for recurrence of periodontitis
- Long-term tooth retention
- Aesthetic appearance

THE FOLLOWING TREATMENT PLAN OUTLINES A POSSIBLE CLINICAL METHODOLOGY:

Suggested treatment concept for periodontally compromised teeth

Diagnosis

Phase I Initial Therapy

Control of clinical parameters: Bleeding on probing (BOP), clinical attachment level (CAL), pocket depth (PD). Decision on further treatment

ReEvaluation

Phase II Consolidation Therapy

Control of clinical parameters: BOP, clinical attachment level, pocket depth. Decision on further treatment

Phase IIIa Tooth Preservation

Periodontal surgery, with GBR/GTR or open flap debridement (OFD)

Phase IIIb Tooth Extraction

Restorative treatment or implant replacement of tooth

Phase IV Maintenance Therapy

Plaque control with or without antibiostical treatment. Periodic control of clinical parameters: BOP, CAL, PD, and bone loss (peri-implantitis) in case of implant placement

Figure 1. Survival analysis. Comparison between hopeless teeth (test group) treated with periodontal regeneration and implant supported teeth at extraction sites of hopeless teeth (control group). Survival at 5 years was 100% in the control group versus 92% in the test group.

Figure 2. Suggested Treatment Concept (Adapted from Newman, Lindhe, Raiterschak)
Defect morphology influences outcome of regenerative therapy

There is a wide range of general factors that are known or assumed to influence periodontal healing (e.g., age, smoking, concomitant medication, postsurgical care, periodontal maintenance, oral hygiene, nutrition, stress). Furthermore, defect morphology is a key factor for the therapy outcome. Each periodontal osseous lesion presents a unique anatomy. A first level of classification differentiates between horizontal, infrabony, and furcation defects as represented in Figure 3. Horizontal defects are defined when the base of the pocket is located coronal to the alveolar crest whereas infrabony defects are apical (vertical defects).

Regenerative therapy (GBR, GTR) is indicated in bony defects with three, two or at least one remaining wall. To some extent also class II furcation defects can be treated with GTR. There is evidence, that 2- and 3 wall infrabony defects respond better to GTR therapy than 1-wall defects. However, the deeper the infrabony defect, the more attachment gain and bony fill may be expected. Other defects with GTR. There is evidence, that 2- and 3 wall intrabony defects and Class II furcation defects can be treated as represented in Figure 3. 17

The present Treatment Concept shows different cases that have been appointed to a classification system combining the remaining walls and the vertical dimension of the bony defect (Figure 4).

Scientific and clinical evidence for the surgical preservative phase

Upon decision to preserve the tooth, the next step is to decide for a surgical therapy: Leading treatment methods often utilise a combination of a slowly resorbing osteoconductive bone substitute and a membrane. 17

GUIDED TISSUE REGENERATION

Some evidence shows, that Guided Tissue Regeneration (GTR) is superior to Open Flap Debridement (OFD) for the treatment of periodontal intrabony and furcation defects. 20-22 Overall, GTR is consistently more effective than OFD in reducing:

- open horizontal furcation depths,
- horizontal and vertical attachment levels, and
- pocket depths for mandibular or maxillary class II furcation defects.

With the use of Geistlich Bio-Oss® orthodontic movement is possible in patients after GTR therapy. 20-22 Moreover, resorbable membranes have proven superior to non-resorbable membranes in generating vertical bone fill. 20

| TABLE 2: Positive and negative defect characteristics 16 |
|-------------------------------|-------------------------------|
| **POSITIVE INFLUENCE**  | **NEGATIVE INFLUENCE**  |
| Deep infrabony component (≥ 3 mm) | Shallow infrabony component (≤ 3 mm) |
| Narrow radiographic defect angle | Wide radiographic defect angle |
| Deep baseline pocket depth | Tooth mobility |

FIGURE 3. Classification of periodontal osseous defects (modified from Papapanou et al 2000) 17

![Figure 3](image_url)

FIGURE 4. Infrabony defects (modified from Papapanou et al 2000) 17

![Figure 4](image_url)

FIGURE 5. The gain in clinical attachment level (CAL) and the reduction in pocket depth (PD) are significantly larger in the test group than in the control group respectively, (p<0.01 and ≤ 0.05 respectively) both after one year and after 5 years. 2

FIGURE 6. The histology assessment demonstrates the presence of new periodontal ligament, cementum, and bone. The newly formed woven bone can be observed maturing into bone trabeculae completely surrounding Geistlich Bio-Oss particles. BO=Bio-Oss; NB=new bone L=ligament; NC=new cementum; OC=old cementum; D=dentin. 19

GEISTLICH BIO-OSS® (COLLAGEN) AND GEISTLICH BIO-GIDE® (PERIO)

Combined filling of periodontal defects with the graft material Geistlich Bio-Oss® Collagen or Geistlich Bio-Oss® followed by Geistlich Bio-Gide® membrane coverage has a history of proven effectiveness in regenerative periodontal therapy. 20-22 Treatment of intra-bony defects with Geistlich Bio-Oss® and Geistlich Bio-Gide® Perio resulted in sustained higher clinical attachment level gain as compared to treatment with OFD alone after 5 years (Figure 5). 2

First clinical and histological results of treatment of endodontic-periodontic lesion with endodontic therapy followed by Guided Tissue Regeneration with Geistlich Bio-Oss® and Geistlich Bio-Gide® demonstrated that the combined approach can promote the formation of new cementum, periodontal ligament, and bone around the apex, as well as the complete bone regeneration of the buccal bone plate (Figure 6). 19

![Figure 6](image_url)
Intrabony 2-wall defect: interproximal crater

**AIM** Functional and esthetic reconstruction in chronic periodontitis with deep intrabony defects.

<table>
<thead>
<tr>
<th>Tooth #</th>
<th>CAL (mm)</th>
<th>PD (mm)</th>
<th>Depth of bony defect (mm)</th>
<th>Defect morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>mesial 10</td>
<td>mesial 10</td>
<td>10</td>
<td>interproximal crater</td>
</tr>
<tr>
<td>21</td>
<td>buccal 5</td>
<td>mesial 10</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

**Biomaterials**

**Suture material**
- 4-0 classic and 6-0 monofilament with cutting needle

**Technique**
- Full thickness flap, split released, papilla preservation

**Periodontal treatment**
- Patient instruction and plaque control for at least 8 weeks.

**Conclusion**
After controlling the periodontal disease, this guided tissue regeneration technique leads to a long-term stable bony situation with pleasant soft-tissue appearance.

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3-wall defect: rapid progression of lesion

**AIM** Regeneration of a 2 to 3 wall defect caused by a cemental tear.

<table>
<thead>
<tr>
<th>Tooth #</th>
<th>CAL (mm)</th>
<th>PD (mm)</th>
<th>Depth of bony defect (mm)</th>
<th>Defect morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>distal 12</td>
<td>distal 7</td>
<td>5</td>
<td>3 wall defect</td>
</tr>
</tbody>
</table>

**Biomaterials**
- Geistlich Bio-Oss®, autogenous bone, Geistlich Bio-Gide®

**Suture material**
- Gore-Tex® Suture CV7

**Technique**
- Periodontal regeneration of the defect by means of GTR

**Periodontal treatment**
- Periodontal defect debridement with hand and ultrasonic instrumentation.

**Conclusion**
The rapid progression of the lesion was arrested and the bone at the defect side successfully regenerated.
Extended 2-wall defect
SURGERY BY PROF. DR. MICHAEL CHRISTGAU, DÜSSELDORF (DE)

AIM Defect resolution of an extended 2-wall defect with regenerative periodontal surgery.

<table>
<thead>
<tr>
<th>Tooth #</th>
<th>CAL (mm)</th>
<th>PD (mm)</th>
<th>Depth of bony defect (mm)</th>
<th>Defect morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>mesial 14</td>
<td>distal 4</td>
<td>mesial 11</td>
<td>distal 2</td>
</tr>
<tr>
<td>buccal 4</td>
<td>1 oral 4</td>
<td></td>
<td>buccal 1</td>
<td>oral 2</td>
</tr>
</tbody>
</table>

Biomaterials
- Geistlich Bio-Oss® Collagen, Geistlich Bio-Gide® Perio, autogenous bone

Suture material
- Seralene® 5-0 and 6-0

Technique
- Papilla-Preservation technique, sulcular incision Regio 43–33 without vertical releasing incisions

Periodontal treatment
- with additional systemic antibiotic therapy (3 x 400 mg metronidazol, 7 days)

Conclusion
Regenerative periodontal surgery with Geistlich Bio-Oss® Collagen and Geistlich Bio-Gide® Perio results in long-term defect resolution.

Periodontal regenerative surgery
SURGERY BY DR. PIERPAOLO CORTELLINI, FIRENZE (IT)

AIM Resolution of deep pockets associated with deep intrabony defects and preservation of aesthetics on upper incisors.

<table>
<thead>
<tr>
<th>Tooth #</th>
<th>CAL (mm)</th>
<th>PD (mm)</th>
<th>Depth of bony defect (mm)</th>
<th>Defect morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 (22)</td>
<td>mesial 7</td>
<td>distal 2</td>
<td>mesial 6</td>
<td>distal 2</td>
</tr>
<tr>
<td>buccal 4</td>
<td>lingual 1</td>
<td>buccal 4</td>
<td>lingual 3</td>
<td></td>
</tr>
</tbody>
</table>

Biomaterials
- Geistlich Bio-Oss®

Suture material
- Gore-Tex® Suture 6-0

Technique
- Modified minimally invasive surgical procedure (M-MIST) with a Microblade USM 6900

Periodontal treatment
- Root planing was performed before surgery.

Conclusion
The combination of the modified minimally invasive surgical technique with Geistlich Bio-Oss® was effective in treating multiple intrabony defects associated with deep pockets in the upper incisors.

References

**Treatment of infrabony 1-wall defect**

**Surgery by Dr. Daniel Etienne, Paris (FR)**

**Non surgical periodontal therapy by Dr. Sofia Aroca, Saint-Germain En Laye (FR)**

**Case 5: Dr. Daniel Etienne**

**Aim**

1 wall periodontal defect treatment before orthodontic tooth intrusion and diastema closure.

<table>
<thead>
<tr>
<th>Tooth #</th>
<th>CAL (mm)</th>
<th>PD (mm)</th>
<th>Depth of bony defect (mm)</th>
<th>Defect morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 buccal</td>
<td>mesial 6</td>
<td>distal 5</td>
<td>mesial 6</td>
<td>distal 5</td>
</tr>
<tr>
<td>11 lingual</td>
<td>mesial 6</td>
<td>distal 3</td>
<td>mesial 6</td>
<td>distal 3</td>
</tr>
</tbody>
</table>

**Biomaterials**

- Geistlich Bio-Oss®, Geistlich Bio-Gide®, Emdogain

**Suture material**

- 6-0 Ethicon PDS-II

**Technique**

- Remote palatal papilla incision and Guided Tissue Regeneration (GTR)

**Periodontal treatment**

- 1. Plaque control
- 2. GTR
- 3. Orthodontic treatment by Dr. Catherine Galletti (Paris)

**Conclusion**

Slight crestal bone remodelling on the mesial aspect of tooth 11 was observed after orthodontic treatment, with 5 mm probing after papilla remodeling. Clinical attachment stability is observed during maintenance.

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**Combination defect**

**Surgery by Prof. Dr. Markus Hürzeler, München (DE)**

**Aim**

Periodontal regeneration of two teeth severely compromised by attachment loss at the apex.

<table>
<thead>
<tr>
<th>Tooth #</th>
<th>CAL (mm)</th>
<th>PD (mm)</th>
<th>Depth of bony defect (mm)</th>
<th>Defect morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td>20, 11, 12</td>
<td>mesial 6, 10, 11</td>
<td>distal 6, 10, 7</td>
<td>mesial 6, 10, 11</td>
<td>distal 6, 10, 7</td>
</tr>
<tr>
<td>11 buccal</td>
<td>5, 8, 9</td>
<td>lingual 5, 6, 7</td>
<td>buccal 5, 8, 9</td>
<td>lingual 5, 6, 7</td>
</tr>
</tbody>
</table>

**Biomaterials**

- Geistlich Bio-Oss®, Geistlich Bio-Gide®, Amelogenin

**Suture material**

- Seralene® suture, DS 12, 15 / 7.0

**Technique**

- Anti-infectious therapy, Doxycyclin (Ligosan® Heraeus), DH (24 hours scaling), reevaluation, 11 + 21 Ca(OH)₂ and root canal filling 21, recall.

**Conclusion**

Successful preservation of two “hopeless” teeth with periodontal regenerative therapy.
Regenerative surgery 11 – perio-endo

**Surgery by Dr. Syed Mahnaz, Perth (AUS)**

**AIM** Retention of the central incisor and improvement of its mobility.

<table>
<thead>
<tr>
<th>Tooth #</th>
<th>CAL (mm)</th>
<th>PD (mm)</th>
<th>Defect morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>mesial 9</td>
<td>distal 5</td>
<td>2 wall defect</td>
</tr>
<tr>
<td>buccal 5</td>
<td>lingual 5</td>
<td>buccal 1</td>
<td>lingual 1</td>
</tr>
</tbody>
</table>

**Biomaterials**
- Geistlich Bio-Oss®, Geistlich Bio-Gide®

**Suture material**
- Vicryl 5.0 suture materials

**Technique**
- Endodontic treatment followed by non-surgical debridement and a modified papilla preservation technique.

**Periodontal treatment**
- Non-surgical periodontal debridement therapy under local anaesthesia with endodontic treatment was undertaken.

01 Non-responder residual pocket associated with a peri-endo-involved tooth 11.

02 Radiograph of infrabony angular defect on tooth 11 with subsequent endodontic treatment.

03 Elevation of flap with papilla preservation to access the infrabony defect.

04 Geistlich Bio-Oss® granules in the defect.

05 Geistlich Bio-Gide® membrane trimmed and placed in the interproximal region.

06 Immediate post-op passive closure and coronal repositioning of the mucosa.

07 Improved apposition and mobility 8 months after surgery and additional composite bonding to improve the aesthetics.

08 Geistlich Bio-Oss® mesial of tooth 11 is well integrated after 6 months.

**CONCLUSION**
Predictable treatment outcomes were achieved to help retain teeth in situations where peri-endo problems exist. Regenerative surgery offers sustainable options for treatment of advanced periodontal disease.

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2-wall defect in the non-aesthetic region

**Surgery by Prof. Dr. Giulio Rasperini, Milan (IT)**

**AIM** Periodontal regeneration to reduce probing depth by increasing bone and periodontal attachment with a minimal gingival recession, to change the prognosis of the tooth # 46 and preserve its function.

<table>
<thead>
<tr>
<th>Tooth #</th>
<th>CAL (mm)</th>
<th>PD (mm)</th>
<th>Depth of bony defect (mm)</th>
<th>Defect morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td>46</td>
<td>mesial 14</td>
<td>distal 3</td>
<td>mesial 14 distal 3 distal 3 max 10</td>
<td>2 wall defect without furcation</td>
</tr>
</tbody>
</table>

**Biomaterials**
- Geistlich Bio-Oss®, Geistlich Bio-Gide®

**Suture material**
- Gore-Tex® Suture 5-0

**Technique**
- Periodontal regeneration procedure with preservation of the interdental tissue and mesial releasing incision.

**Periodontal treatment**
- Cause related periodontal therapy, including motivation and instructions for home care; professional supra-gingival debridment and sub-gingival root planing. Re-evaluation for potential additional therapy.

01 Baseline situation showing the 14 mm pocket depth mesial to tooth 46.

02 Baseline radiograph showing the presence of an angular bony defect involving the mesial site of tooth 46.

03 Elevation of a full-thickness buccal and lingual flap with papilla preservation. The 10 mm deep, 2-wall intrabony defect was evident after careful debridement.

04 The Geistlich Bio-Oss® fills the defect and is protected by a Geistlich Bio-Gide® membrane. After flap release, the wound is closed without tension.

05 Re-evaluation at 1 year. A residual 5 mm probing depth is present with a 9 mm probing depth loss as compared to baseline measurements.

06 Nearly complete bone fill of the angular defect at 1 year.

**CONCLUSION**
2 months after conclusion of presurgical, cause-related therapy, the patient reported the complete resolution of inflammation, resulting in a decrease of the full mouth plaque and bleeding scores. 1 year after the surgery, the soft-tissue was well preserved and represented with a sufficient width of keratinised gingiva. Radiographs after 1 year show a stable situation with an almost complete bone fill.
Deep intrabony 2-wall defect

SURGERY BY PROF. DR. ANTON SCULEAN, BERN (CH)

**AIM**
Treatment of intrabony defect with a complicated, non-contained morphology using a combination of collagen barrier membrane and a natural bone mineral.

<table>
<thead>
<tr>
<th>Tooth #</th>
<th>CAL (mm)</th>
<th>PD (mm)</th>
<th>Depth of bony defect (mm)</th>
<th>Defect morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>distal 11</td>
<td>distal 11</td>
<td>5</td>
<td>2 wall, large non-contained defect</td>
</tr>
</tbody>
</table>

**Biomaterials**
- Geistlich Bio-Gide® Perio, Geistlich Bio-Oss®

**Suture material**
- 4-0 silk

**Technique**
- Periodontal regeneration of a large non-contained defect through GTR with the use of grafting material.
- Hygienic phase 3 months before regenerative surgery consisting of patient instruction for oral hygiene, and full-mouth scaling and root planing in conjunction with systemically administered antibiotic therapy (3 x 375 mg Amoxicillin and 3 x 250 mg Metronidazol) for one week.

**Biomaterials**
- Geistlich Bio-Oss® Collagen, Geistlich Bio-Gide® Perio

**Suture material**
- Seralene® 7/0 (PVDF, Serag Wiessner)

**Technique**
- Minimal invasive surgical technique (MIST) (Cortellini 2009)

**Periodontal treatment**
- Initial periodontal treatment (4hrs), 3-months recall

**Reference**

**CONCLUSION**
Good appearance of soft tissue and sufficient bone fill at 1 year after regeneration of a deep non-contained bony defect.

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2-wall defect in the aesthetic zone

SURGERY BY DR. BEAT WALLKAMM, LANGENTHAL (CH)

**AIM**

<table>
<thead>
<tr>
<th>Tooth #</th>
<th>CAL (mm)</th>
<th>PD (mm)</th>
<th>Depth of bony defect (mm)</th>
<th>Defect morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>mesial 11</td>
<td>distal 4</td>
<td>mesial 8, distal 3</td>
<td>2 wall defect</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>buccal 4, lingual 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>buccal 2, lingual 3</td>
<td></td>
</tr>
</tbody>
</table>

**Biomaterials**
- Geistlich Bio-Oss® Collagen, Geistlich Bio-Gide® Perio

**Suture material**
- Seralene® 7/0 (PVDF, Serag Wiessner)

**Technique**
- Minimal invasive surgical technique (MIST) (Cortellini 2009)

**Periodontal treatment**
- Initial periodontal treatment (4hrs), 3-months recall

**CONCLUSION**
The minimally invasive surgical technique in combination with Geistlich Bio-Oss® Collagen and Geistlich Bio-Gide® Perio resulted in markedly improved clinical and radiographic outcome.

**Reference**
**2-wall wide intrabony defect**

**AIM**

Regenerative surgery of a severely compromised tooth in aesthetic area.

**Tooth**

<table>
<thead>
<tr>
<th>CAL (mm)</th>
<th>PD (mm)</th>
<th>Depth of bony defect (mm)</th>
<th>Defect morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td>mesial 3</td>
<td>distal 13</td>
<td>mesial 3</td>
<td>distal 11</td>
</tr>
<tr>
<td>buccal 11</td>
<td>lingual 3</td>
<td>buccal 11</td>
<td>lingual 3</td>
</tr>
</tbody>
</table>

**Biomaterials**

- Geistlich Bio-Oss®, Geistlich Bio-Gide®, Amelogenin

**Suture material**

- PGA 7.0 in the papilla / PGA 6.0 in the flap

**Technique**

- Regenerative surgery with CAF combined with simplified papilla preservation

**Periodontal treatment**

- Ultrasonic periodontal therapy before the surgery

- EDTA and an amelogenin derivative matrix are applied to condition the root surface.

- Geistlich Bio-Oss® fills the wide defect and Geistlich Bio-Gide® prevents tissue collapse while stabilizing the site.

- The defect after degranulation.

- Post-op view of suturing: note the primary intention closure of the interdental papilla above the defect.

**References:**

1. Wang HL et al., J Periodontol. 2005 Sep; 76(9):1601-1622
5. Zitzmann NU et al., Int Endod J. 1999 Sep;32(9):757-774
30. Tonetti MS et al., J Clin Periodontol. 2004 Sep;37(9):770-776

**CONCLUSION**

Healthy hard- and soft-tissue situation with regrowth of the interdental papilla after 1 year.
Product Range for periodontal treatment *

**Geistlich Bio-Oss®**
Spongious bone substitute
Small granules 0.25 mm – 1 mm
Available sizes:
- 0.25 g ≈ 0.5 cc
- 0.5 g ≈ 1 cc
- 2 g ≈ 4 cc

**Geistlich Bio-Oss®**
Spongious bone substitute
Large granules 1 mm – 2 mm
Available sizes:
- 0.5 g ≈ 1.5 cc
- 2 g ≈ 6 cc

**Geistlich Bio-Gide®**
Resorbable bilayer membrane with sterile templates
Available sizes:
- 16 mm x 22 mm

**Geistlich Bio-Gide®**
Resorbable bilayer membrane
Available sizes:
- 25 mm x 25 mm
- 30 mm x 40 mm

**Geistlich Bio-Oss® Collagen**
Spongious bone substitute
Preformed block with Collagen
Available sizes:
- 100 mg
- 250 mg
- 100 mg

**Geistlich Bio-Oss® Collagen**
Spongious bone substitute
Preformed block with Collagen
Available sizes:
- 100 mg
- 250 mg
- 500 mg

**Geistlich Bio-Gide® Perio**
Resorbable bilayer membrane
Available sizes:
- 16 mm x 22 mm

**Geistlich Bio-Gide® Perio**
Resorbable bilayer membrane
Available sizes:
- 25 mm x 25 mm
- 30 mm x 40 mm

**Geistlich Comb-Kit Collagen**
Geistlich Bio-Oss®
Collagen 100 mg
Geistlich Bio-Gide®
16 x 22 mm

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* Product availability may vary from country to country.