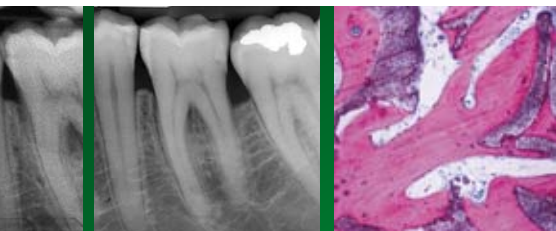


# STARGET **FOCUS**

02 | 2007



**Straumann® Regenerative System –**  
Clinical Procedures for  
Periodontal and Guided Bone Regeneration

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**SIMPLY DOING MORE**  
FOR DENTAL PROFESSIONALS



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## STRAUMANN® REGENERATIVE SYSTEM



### Periodontal regeneration with Straumann® Emdogain

The evolution of Straumann® Emdogain is based on a breakthrough in the knowledge of the underlying biology of tooth development, which is found in enamel matrix proteins, a complex of native proteins that play a key role in the development of tooth-supporting tissues. Comprised of various proteins, which self-assemble to create this matrix, Straumann® Emdogain provides the catalyst for the formation of cementum on the root of the affected tooth, thus providing a foundation for all necessary tissues associated with a true functional attachment.

Since its introduction in 1997 the efficacy and clinical benefit of Straumann® Emdogain has been proven in many clinical studies for indications like intrabony-, furcation- and recession defects. These indications are the subject of the following case presentations, in which we show how true periodontal regeneration can be achieved through the use of Straumann® Emdogain and Straumann® Emdogain PLUS.



### Guided bone regeneration with Straumann® BoneCeramic

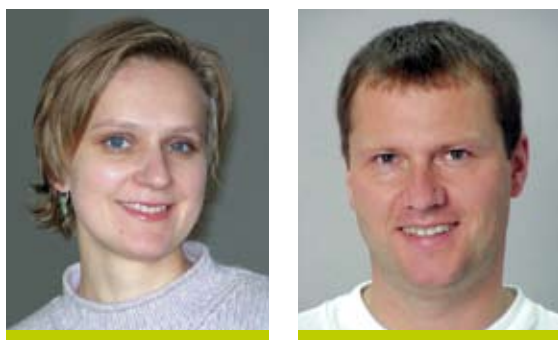
Straumann® BoneCeramic is a fully synthetic bone substitute material. It is composed of biphasic calcium phosphate, a combination of 60 % hydroxyapatite (HA) and 40%  $\beta$ -tricalcium phosphate (TCP).

The dissolution of TCP provides a source for calcium and phosphate ions and initiates mineralization. The HA phase maintains the supporting structure (scaffold) for bone deposition and protects the augmented volume from excessive resorption.

Thus, the resorption characteristics of this novel biphasic calcium phosphate lead to a gradual substitution of the material with new bone and structural support of the augmented bone volume.

The current issue of TARGET Focus presents clinical and histological evidence for the suitability of Straumann® BoneCeramic in Guided bone regeneration. Experienced surgeons report on the clinical outcomes and their approach for effective bone regeneration and stabilisation of dental implants.

## INTRABONY DEFECT TREATMENT WITH STRAUMANN® EMDOGAIN



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### Clinical case by Dr. Bjarni E. Pjetursson and Dr. Giedre Matuliene

#### Introduction

A 38-year-old male patient, non-smoker, was referred by his nephrologist to the Department of Periodontology and Fixed Prosthodontics, School of Dental Medicine, University of Bern, Switzerland. The patient had a kidney transplant seven years prior to the referral and attends regular check-ups at the University Hospital. He is on  $\beta$ -blocker due to high blood pressure and on immune-suppressive medication.

#### History

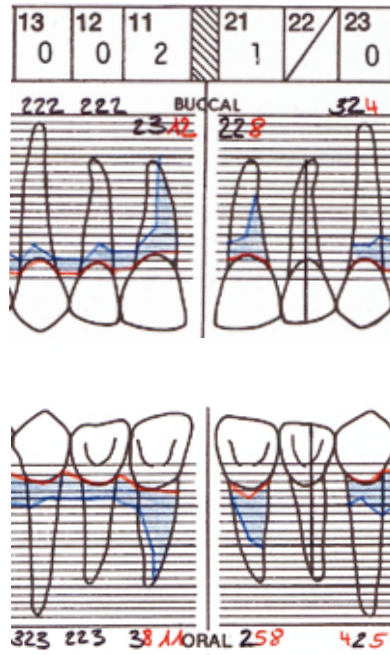
The patient's chief complaint was the mobility and pain on pressure of tooth 11, which caused discomfort when biting. The patient had also noticed that the diastema between the two upper central incisors had increased substantially during the last year. Occasionally, he noticed suppuration from tooth 11. He had previously been informed that his periodontal infection could have a negative effect on his general health. The patient wished to treat his periodontal disease, and to keep all his teeth, if possible.

#### Examination

The redness and swelling of the gingiva and the alveolar mucosa was clearly visible around tooth 11 (Fig 1). The periodontal chart revealed a recession of 1 mm and a probing pocket depth (PPD) of 12 mm on tooth 11 indicating a clinical attachment loss of 13 mm mesial to tooth 11 (Fig 2). On the periapical radiograph, a vertical bony defect, extending down to the apical 1/3 of the root, could be seen on tooth 11 (Fig 3). Full mouth bleeding on probing index (BOP)<sup>1</sup> was 47% and the Plaque Control Record (PCR)<sup>2</sup> was 22% prior to treatment. Tooth 11 and 21 both responded positively to vitality testing. Microbiological samples were obtained from the four deepest pockets. The DNA-DNA Checkerboard Hybridization analysis revealed high scores of periodontal pathogen bacteria belonging to the red and orange complexes.<sup>3</sup>



**Fig 1** - Frontal view before treatment. The redness of the gingiva and the alveolar mucosa is clearly visible.



**Fig 2** - Periodontal chart before treatment.



**Fig 3** - Periapical radiograph before treatment showing the vertical bony defects on teeth 11 and 21.

## Diagnosis

The patient had localized aggressive periodontitis. The diagnosis was based on the presence of *Aggregatibacter actinomycetemcomitans* and the extent of tissue destruction, which was inconsistent with the low plaque score.

## Prognosis

The extent of attachment loss on tooth 11 was very severe and the only possibility to save this tooth would be with periodontal regeneration. A positive aspect was the patient's motivation and that he wanted to save the tooth at all costs. He also had good oral hygiene and was a non-smoker. However, the influence of the immune-suppressive medication on periodontal regeneration is not known and regeneration of a 1-wall defect is very difficult.

## Treatment sequence

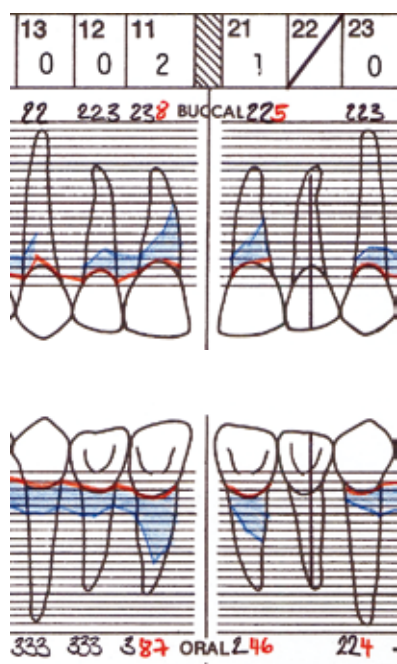
### Systemic phase

The nephrologist recommended antibiotic prophylaxis prior to each treatment session. Therefore, treatment was performed in few long sessions.

### Hygienic phase

The etiology and progression of gingivitis and periodontitis was explained to the patient using a special motivation sheet. The instructions on oral hygiene included the use of an electric toothbrush, interdental brushes and dental floss for interdental cleaning. The patient was shown how to apply chlorhexidinegel locally on tooth 11. In two sessions, the supra- and subgingival plaque and calculus were removed with the ultrasonic scaler and root-planing was performed with hand instruments under local anaesthesia. At the time of the re-evaluation,

which took place six weeks after the last instrumentation, there was still an 8 mm pocket on tooth 11 (Fig 4). The full mouth BOP decreased to 23%.



**Fig 4** - Periodontal chart after hygienic phase.



**Fig 5** - Intraoperative view of the vertical bony defects.



**Fig 6** - Flap adaptation with single, horizontal, and vertical matrix sutures using 5/0 monofilament suture material.

### Corrective phase

In the upper anterior sextant, a periodontal access flap surgery was carried out. From tooth 13 to tooth 23, intra-sulcular incisions were performed buccally and palatally. The Modified Papilla Preservation Technique (MPPT)<sup>4</sup> was performed between tooth 11 and tooth 21 and the Simplified Papilla Preservation Technique (SPPT)<sup>5</sup>, was utilized for the other interdental spaces. A mucoperiosteal flap was elevated. Granulation tissues were removed and the root surfaces cleaned with ultrasonic scaler and hand cures. Finally the root surface was smoothed with a fine rotating diamond instrument (Periojet®).

The bony defects on tooth 11 and tooth 21 were evaluated intraoperatively. The bony defect on the mesial aspect of tooth 11 was 10 mm in depth and 3 mm in width. The apical part was a 3-wall defect extending mesial and palatal, but in the coronal

the buccal bony wall was missing. On the distal side of tooth 21, there was a 3-wall defect, 4 mm in depth and 3 mm in width (Fig 5). Straumann® Emdogain was used in an attempt to regenerate the missing periodontal tissues. After cleaning and smoothing the root surfaces, the defects were rinsed with sterile saline solution and subsequently dried with a surgical suction. In order to achieve haemostasis and to keep the root surface clean and dry, a moist sterile gauze (not dry) was packed into the defects and left for 1–2 minutes.

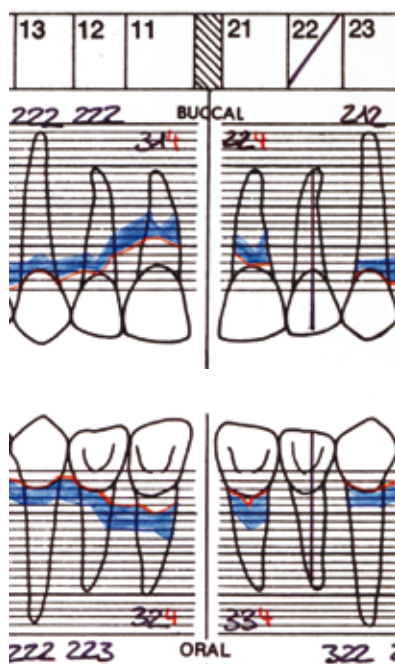
Immediately after removing the sterile gauze, Straumann® PrefGel was applied and left for two minutes to condition the root surfaces. In order to apply the Straumann® PrefGel on the root surface deep down into the defect, a periodontal probe was used. After two minutes, the Straumann® PrefGel was rinsed away with a large amount of sterile saline solution. The defects were dried again with the

surgical suction in combination with a moist sterile gauze (care must be taken not to dehydrate the cementoblasts on the root surface). Furthermore, airflow should not be used to dry the root surfaces. Finally, Straumann® Emdogain was applied on the clean and dry root surfaces and into the defects.

Trimming of the flap was performed before application of Straumann® PrefGel and Straumann® Emdogain, so that flap adaptation could be carried out immediately after the application. The mucoperiosteal flap was adapted with single sutures, horizontal and vertical matrix sutures using monofilament 5/0 suture material (Fig 6). The excess Straumann® Emdogain was applied on the wound margins.



**Fig 7** - Frontal view after treatment. Buccal and mesial of tooth 11 exhibits a recession of 3 mm.



**Fig 8** - Periodontal chart one year after treatment.



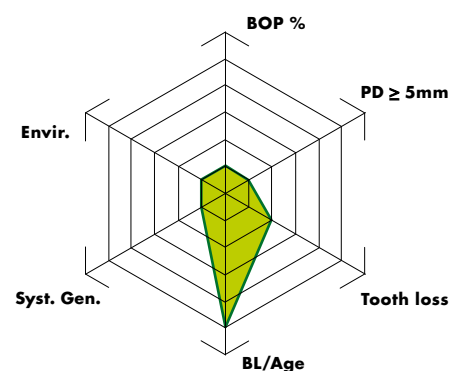
**Fig 9** - Radiographic examination after treatment showing significant bone gain both on tooth 11 and on tooth 21.

After the surgery, the patient was instructed to rinse with 0,1 % chlorhexidine for one minute twice daily for a period of three weeks. Based on the result from the microbiological test, a combination of metronidazole (3 x 250 mg) and amoxicillin (3 x 375 mg) was prescribed for a period of one week. Sutures were removed after one week and the patient was instructed to brush using an extra-soft toothbrush for the surgical area. The second follow-up appointment was scheduled for three weeks later to provide instruction on interdental cleaning. The third appointment was at six weeks after surgery to reinforce oral hygiene. The healing was uneventful. As expected, the mobility of tooth 11 increased after surgery. Hence it was decided to splint tooth 11 and tooth 12 to stabilise tooth 11 and to increase chewing comfort for the patient.

The re-evaluation one year after surgery revealed no pockets deeper than 4 mm. On the mesial aspect of tooth 11 there was a recession of 3 mm and a pocket of 4 mm, which gave the gain of attachment of 6 mm (Fig 7 and 8). The radiographic examination showed significant bone gain both on tooth 11 and on tooth 21 (Fig 9). The plaque index was 5 % and full mouth BOP was only 3 % representing a stable situation.<sup>6</sup> Both teeth remained vital.

### Maintenance phase

Based on a periodontal risk assessment<sup>7</sup> after surgery (Fig 10), there is one high-risk factor: the ratio between bone loss and age of the patient. Other risk factors were in the medium or low category. Therefore, the patient was placed on the recall-interval of four months.



**Fig 10** - Periodontal risk assessment with six different risk categories.

## RECESSION TREATMENT WITH CORONALLY ADVANCED FLAP TECHNIQUE (CAF) AND STRAUMANN® EMDOGAIN



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### Clinical case by Dr. S. Hägewald

#### **Straumann® Emdogain in the treatment of gingival recessions**

Modern-day esthetic demands have elevated the treatment of exposed root surfaces to becoming an important therapeutic issue. Among the treatment options discussed in research journals, the combined use of coronally advanced flaps (CAF) with the additional application of Straumann® Emdogain leads to the most predictable results with good long-term results.

In a modern practice, two main groups of procedures can be distinguished: Free graft and pedicle flap.

With soft tissue free grafts from the palate, different surgical techniques have been reported, but the predictability and the esthetic results have often not been satisfactory. The esthetic outcomes were more favorable with modified techniques by subpedicle or subepithelial connective tissue graft. However, all autotransplantation procedures require harvesting the graft from a donor area which results in an additional wound site and discomfort for the patient.

Pedicle flaps without tissue grafts have been used successfully for root coverage in different modifications. The coronally advanced flap technique (CAF) was shown to be a predictable method for recession coverage with reproducible satisfactory esthetic results. However, the limiting factor for recession coverage is the height of the approximate tissue.<sup>8</sup> The coronally advanced flap should not be put over crowns or prosthetic restorations, but can be placed over a clean dentin surface that was previously covered by a restorative material.

Guided tissue regeneration (GTR) has also been applied to the treatment of gingival recession with the goal of obtaining both root coverage and new connective tissue attachment.<sup>9,10</sup> Root coverage obtained by ePTFE membranes or resorbable membranes have resulted in acceptable but variable results. For instance, problems that occurred with the membrane technique include technical difficulties in optimally placing the barrier, membrane exposure in the course of healing and possible damage to the newly formed tissue due to membrane removal or absorption.

As for the patient, the stability of the defect coverage is of the utmost importance as well as the true regeneration of the involved tissue. Here, the regenerative potential of Straumann® Emdogain comes into play, in order to improve the tissue quality and quantity after recession coverage procedures on previously exposed root surfaces.<sup>11,12</sup> This is especially important in very large defects and in defects with thin residual tissue. Significantly improved root coverage could be established through the additional use of Straumann® Emdogain in conjunction with CAF.<sup>13,14</sup> The regenerative potential of Straumann® Emdogain in recession coverage procedures could also be shown with human histologies.<sup>15</sup>

Based on the positive clinical results, together with the scientific evidence, the combination of CAF and Straumann® Emdogain has become the treatment of choice for large recessions. The following case report describes a typical recession coverage procedure treated with Straumann® Emdogain and CAF, including long term results.

### Case report

The female patient is 45 years old and a non-smoker, with good oral hygiene and no history of periodontitis. She suffered from several recession defects in the upper jaw and was not satisfied with the compromised esthetics, particularly on her right canine. She wanted a treatment that would restore the gingiva (Fig 1).

A recession of 4 mm at tooth 13 was present, covered with a composite filling from the referring dentist and recessions of around 3 mm at the upper premolars, which were restored with ceramic crowns. Approximately 2 mm keratinized gingiva was present on tooth 13 with an average tissue thickness. The approximate papillae were completely preserved, and no pathological probing pocket depths were found. On the basis of this, the patient's wish and our aim for treatment was full coverage of tooth 13. The decision was made to use the CAF procedure in combination with Straumann® Emdogain, in order to promote tissue regeneration and a long-time stable result.

### Surgical Approach

After a local anesthesia the composite filling was reduced, so that the remaining margin of the filling extended to the desired new tooth length (Fig 2).

A full thickness flap was elevated around the recession. A horizontal intracrevicular incision was made at the recession (Fig 3) and extended with two releasing incisions to the mucogingival junction corresponding to the line angles (Fig 4).

The interdental papillae were preserved as much as possible. Their facial proportion was de-epithelialized to create a connective tissue bed (Fig 5). A horizontal



**Fig 1** - Preop. 4 mm recession at tooth 13, covered with composite filling. Recessions of around 3 mm at the upper premolars, restored with ceramic crowns, are also visible.



**Fig 2** - Composite filling reduced to the desired new tooth length.



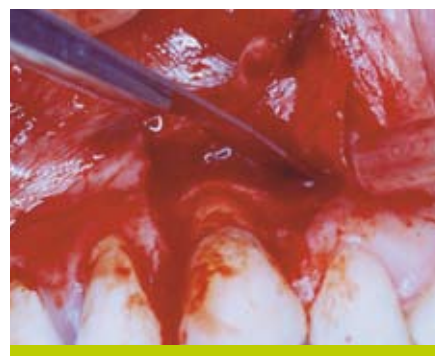
**Fig 3** - Horizontal intracrevicular incision made at the recession.



**Fig 4** - The two releasing incisions extend to the mucogingival junction in correspondence to the line angles.



**Fig 5** - The mucoperiosteal flap is released over the mucogingival line. The bony dehiscence on the buccal surface is exposed. Epithelium in the papilla region is removed and the connective tissue is exposed.



**Fig 6** - Horizontal releasing incision in the periosteum at the base of the flap.

releasing incision was placed in the periosteum at the base of the flap (Fig 6). In this case, it is essential that the flap covers the recession tension free (Fig 7).

Straumann® Emdogain, Straumann® PrefGel and a saline solution were set up in such a way that would allow their application in rapid sequence. The root surface was then conditioned with 24% EDTA (Straumann® PrefGel) for two minutes and thoroughly rinsed with sterile saline. Straumann® Emdogain was immediately applied to prevent conta-

mination trough saliva or blood as suggested by the manufacturer (Fig 8).

The coronally advanced flap was secured at the level of the cemento-enamel junction by suturing to the de-epithelized papilla regions using monofilament 5/0 material. Supporting sutures must be placed to stabilize the flap (Fig 9).



**Fig 7** - It is essential that the flap is tension-free and covers the recession.



**Fig 8** - Immediate application of Straumann® Emdogain after root conditioning.



**Fig 9** - Supporting sutures must be implemented to stabilize the flap.



**Fig 10** - Suture removal nine days post-op. The flap remains in place and is well vascularized.



**Fig 11** - Clinical appearance five weeks post-op. The flap is well integrated and appears in a practically mature state.



**Fig 12** - Three years post-op the complete coverage is obvious. The premolars have also been treated and restored with new crowns.

In the postoperative phase the patient was advised not to brush the area and to rinse twice daily with chlorhexidine (0,12%) for three weeks.

Healing was uneventful, with no complications. Sutures were removed after nine days (Fig 10). The flap remained in place and was well vascularized.

After four weeks the flap was well integrated and appeared almost mature (Fig 11).

Following the successful treatment the patient decided on a recession treatment for the adjacent premolars. The existing crowns had to be removed and a similar procedure was performed. The results after three years can be seen in Fig 12. The recession coverage was still completely maintained and long-term stability was achieved.

### Conclusion

Of the established surgical procedures for recession coverage, the combination of CAF with Straumann® Emdogain is a consistent and reliable technique that can be performed in daily practice. It is less complicated than the alternative methods with the use of membranes. There are also fewer complications and less pain than with graft technique with a second palatal wound.<sup>15</sup> However, the technical skills of the operator have a significant influence on the clinical outcome.

This method described in this report offers the possibility of achieving long-term stable recession coverage and the sustainment of gingival aesthetics.

## CLASS II FURCATION TREATMENT WITH STRAUMANN® EMDOGAIN



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**Clinical case by Dr. D. Nisand**

Periodontitis is an inflammatory disease affecting the supporting tissues of the teeth, resulting in the progressive deterioration of the periodontal ligament and alveolar bone with pocket formation and recession. The main objective of conventional periodontal therapy is to control infection and establish a local environment and microflora compatible with periodontal health through non surgical and surgical therapy. Ultimately, the ideal goal of periodontal treatment would be the regeneration (new cementum, periodontal ligament and bone) of the tissues that have been lost due to disease in intrabony and furcation defects.

Several regenerative techniques have been suggested with varying results during the past decades. One of the more recently developed products is Straumann® Emdogain, which is composed of enamel matrix proteins (mainly amelogenins) derived from embryonic porcine tooth germ.

Straumann® Emdogain has been extensively studied in animals<sup>16</sup> and humans<sup>17</sup>, providing histological evidence of tissue regeneration. Clinical efficacy and safety have also been demonstrated in both animals<sup>18</sup> and humans.<sup>19,20</sup> Results from clinical studies have documented that treatment of intrabony defects with Straumann® Emdogain may result in statistically significant gains of clinical attachment and bone when compared to conventional surgical approach.<sup>21</sup> Furthermore, no significant differences in

terms of clinical outcomes were demonstrated between Straumann® Emdogain and guided tissue regeneration except for postoperative complications which were significantly higher with membranes.<sup>22</sup>

Among periodontal defects, surgical treatment of class II furcation remains a challenge for clinicians. Results from animal studies<sup>23</sup> have indicated that Straumann® Emdogain leads to a significant regeneration of the furcation lesions. Moreover, in a randomized clinical trial comparing Straumann® Emdogain and resorbable membrane in the treatment of buccal Class II furcation in mandibular molars, Jepsen et al<sup>24</sup> have demonstrated a significant reduction in horizontal furcation depth and a lower incidence of post-operative complications following Straumann® Emdogain compared to membrane.

The purpose of the present case report was, therefore, to present the clinical treatment and follow up of class II furcation involvement in mandibular molar treated with Straumann® Emdogain.

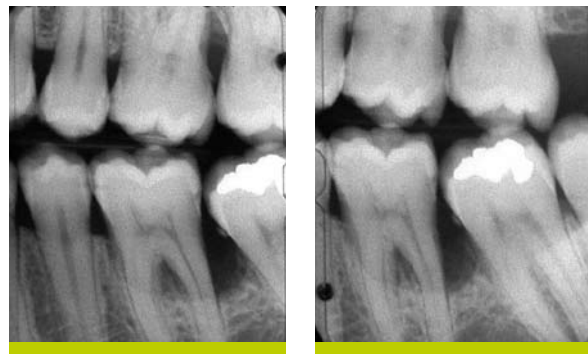
### Case report

A 26-year-old female patient was referred to our clinic for treatment of a localized aggressive periodontitis, characterized by a 7 to 9 mm pocket depth and angular bone loss on the first molars and central incisors. Otherwise, she was in good general health and non-smoker. She received basic treatment for periodontal disease including oral hygiene instruction as well as scaling and root planning under local anesthesia, followed by an adjunctive treatment with systemic antibiotics (750 mg metronidazole and 750 mg amoxicillin) for seven days. Two months after the completion of basic therapy the patient had a high level of oral hygiene (full-mouth plaque index < 10%) and a marked reduction of the bleeding on probing.

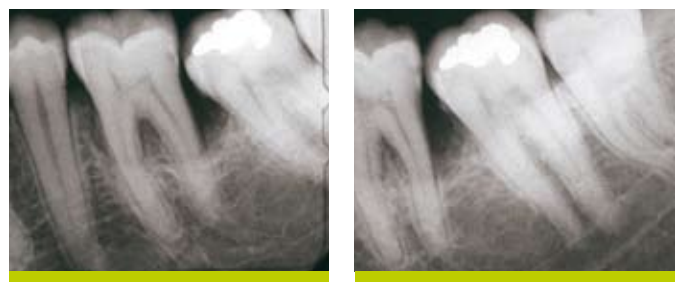
All sites with probing pocket depths  $\geq 6$  mm and intrabony components  $\geq 3$  mm were scheduled for regenerative surgery. Clinical and radiographic evaluation of the left mandibular first molar indicated an 8 mm pocket depth (Fig 1) with a 5 mm intrabony defect on the distal aspect of the tooth (Figs 2 and 3) together with a class II lingual furcation (horizontal probing depth of 4 mm).



**Fig 1** - Preoperative view of tooth 36 affected by a lingual Class II furcation defect and an 8 mm probing pocket depth on the distal aspect.



**Fig 2** - Preoperative radiograph showing an intrabony defect on the distal aspect of the tooth together with radiolucency in the furcation area.



**Fig 3** - Preoperative radiograph. Note the 5 mm intrabony defect.



**Fig 4** - Full-thickness flap raised buccally.



**Fig 5** - Full-thickness flap raised lingually exposing a class II furcation.



**Fig 6** - Intrabony defect after debridement.

Following local anesthesia, buccal and lingual intracrevicular incisions were placed, and full-thickness flaps were raised buccally (Fig 4) and lingually (Fig 5). All granulation tissue was removed from the defects and the root surfaces and the furcation area were carefully scaled and planned with hand and ultrasonic instruments (Fig 6). The root surfaces were conditioned for two minutes with 24% EDTA gel (Straumann® PrefGel) in order to remove the smear layer. The area was then thoroughly rinsed with sterile saline solution. The defect and the exposed root surface were subsequently cleaned with sterile gauze to remove all saliva and blood contamination from the root surface. Straumann® Emdogain was immediately applied onto the exposed root surface (Fig 7). The flap was then replaced and sutured with vertical mattress (5/0) to obtain a complete coverage of the intrabony defect (Fig 8) and to cover the coronal entrance of the furcation.

Following surgery, postoperative pain was controlled with 30 mg dextropropoxyphene combined with 400 mg paracetamol (Di-Antalvic®, Sanofi Aventis). The patient was instructed to rinse twice daily with 0,12% chlorhexidine (Paroex®, Sunstar Medicadent), to apply a 0,2% chlorhexidine gel (Elugel®, Pierre Fabre) twice daily after rinsing and to use modified oral hygiene procedures in the treated area during the first four postoperative weeks.

Two weeks following surgery sutures were removed and supragingival prophylaxis was performed. The patient was recalled for professional tooth cleaning at a two-month interval (Figs 9 and 10) for the first six months. No attempt at probing was performed before six months.



**Fig 7** - Application of Straumann® Emdogain onto the exposed root surface facing the defect.



**Fig 8** - Flaps replaced and sutured with vertical mattress.



**Fig 9** - Clinical view (buccal side) two months following surgery.



**Fig 10** - Clinical view (lingual side) two months following surgery.



**Fig 11** - Two-year postoperative radiograph showing almost complete bone fill.

Six months after the operation a pocket depth reduction of 5 mm was observed with no concomitant recession and a residual pocket depth of 3 mm, with no bleeding on probing on the distal aspect of the tooth. A complete furcation closure was obtained lingually.

Six months after the completion of the regenerative therapy, an orthodontic treatment was performed to correct malposition and dental migration.<sup>25</sup> During orthodontic treatment, the patient was recalled for professional tooth cleaning at two month intervals and at three month intervals during the supportive periodontal therapy. Radiographic evaluation two years after the completion of the orthodontic treatment indicates a bone densification and an adequate filling of the intrabony defect (Fig 11).

### Conclusion

The present case, which has dealt with treatment of mandibular class II furcation, together with more recent clinical research, indicates that Straumann® Emdogain can be considered as a very effective regenerative treatment procedure in mandibular as well as maxillary class II furcation. Indeed, its primary advantage is regeneration without the complications associated with membrane techniques.

Moreover, in the treatment of deep-wide furcation defects, Straumann® Emdogain, in combination with a bone substitute, can be considered as a comprehensive treatment in preventing the collapse of the flap in the bony defect and in the enhancement of wound stability.

## WIDE INTRABONY DEFECT TREATMENT WITH STRAUMANN® EMDOGAIN PLUS



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### **Clinical case by Prof. Dr. H. Topoll**

#### **Introduction**

In the regenerative treatment of wide intrabony defects with Straumann® Emdogain, additional space maintenance for two and one wall bony defects is often desired to prevent soft tissue ingrowth and to prevent gingival recession. The use of Straumann® Emdogain PLUS, a combination of Straumann® Emdogain and Straumann® BoneCeramic, combines the regenerative properties of Straumann® Emdogain with the structural support of the osteoconductive Straumann® BoneCeramic.

#### **Case Report**

Wide periodontal defects often require additional support of the interdental soft tissue to prevent its collapse and minimize recession. Straumann® Emdogain has proven to be effective in the partial or complete regeneration of periodontal tissues in intrabony defects. For wide defects it has been used in conjunction with bone grafts and various bone substitute materials. The following case describes the combined use of Straumann® BoneCeramic and Straumann® Emdogain.

The patient, a healthy 55 year old female and a non-smoker, was referred by her general dentist for periodontal treatment. The initial probing depth at tooth 13 was 11 mm mesiobuccal and 10 mm distobuccal. Due to the poor prognosis of tooth 13 the dentist wanted to extract the tooth and fabricate a cover denture. In all probability, the prognosis of a prosthesis fixed on the four remaining upper anterior teeth after extracting tooth 13 would be poor. Moreover, it was the patients wish to save the tooth and a fixed prosthesis on her upper front teeth.



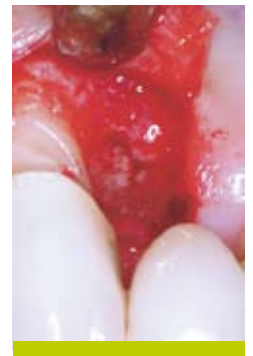
**Fig 1** - Preoperative X-Ray; defect was 6 mm deep and 4 mm wide.



**Fig 2** - Pre operative clinical view.



**Fig 3** - Circumferential defect on the palatal sides extending into a wide 2-wall defect mesiobuccal and distobuccal.



**Fig 4** - After application of Straumann® Emdogain on the root surface the defect was filled with granules of Straumann® BoneCeramic.

The patient underwent an initial treatment phase, consisting of oral hygiene instructions and two sessions of subgingival scaling under local anesthesia and a concomitant systemic antibiotic treatment with amoxicillin and metronidazol for seven days. Six weeks after treatment a reevaluation showed the initial probing depth had been reduced from 11 mm to 7,4 mm mesiobuccal and from 10 mm to 5 mm distobuccal. The general level of the patient's oral hygiene improved dramatically during the initial treatment phase. The O'Leary Plaque Index was reduced to 15%.

The decision was made to follow a regenerative procedure using Straumann® Emdogain PLUS, a combination of Straumann® Emdogain and Straumann® BoneCeramic.

Straumann® Emdogain was selected over a resorbable membrane due to the smaller number of postoperative complications exhibited<sup>24</sup> as well as its easier handling properties. Indeed, optimal wound healing, important in this esthetic zone, could be best achieved with Straumann® Emdogain.<sup>15</sup>

To prevent further recession in the esthetic zone, a filler had to be used to prevent a collapse of the gingival tissues and to keep the gingival tissues as coronal as possible. Straumann® BoneCeramic was chosen for its osteoconductive- and resorption properties as well as accommodating the patients' preference for a non bovine bone material.



**Fig 5** - Post-op. Wound closure was achieved using horizontal mattress and interrupted sutures.



**Fig 6** - One week post-op soft tissue wound healing was nearly completed.



**Fig 7** - X-ray control 6 months post-op. The PD had decreased midbuccal from 7,4 mm to 4,2 mm, at the distobuccal site from 5 mm to 4 mm

### Surgical Approach

The bony defect was circumferential at the palatal side, developing into a wide two wall defect to the mesiobuccal and distobuccal. At the mid buccal and the mid palatal surface, sulcular incisions were made. Mesio- and distobuccal perpendicular incisions were made to the bone, approximately 1 mm away from the bony defect border.

To get as much access to the bony defect as possible, vertical releasing incisions were made mesially and distally approximately 1–2 mm away from the bony defect, again on bone. The flaps were reflected after a sharp horizontal incision over the bony defect. After careful reflection of the flap, all granulation tissue was removed by sonic scalers and hand instruments. Mesiobuccal, the bony defect was 6 mm deep and 4 mm wide (Fig 3).

The root surface was cleaned first by hand instruments and thereafter by sonic scalers. Further root conditioning was achieved by using Straumann® PrefGel for two minutes to remove the smear layer. After rinsing thoroughly with saline solution, approximately half of the 0,7 ml syringe of Straumann® Emdogain was applied to the dry root surface. The remaining part of Straumann® Emdogain was mixed with Straumann® BoneCeramic directly in the blister. The resulting mixture had an easy to handle putty like consistency. Gently, the defect was completely filled, up to the coronal levels of the bony defects. Care was taken not to overfill the defect, which might impair a good wound closure and prevent primary wound healing (Fig 4). Shortly before suturing, the remaining Straumann® Emdogain was placed over the filled bony defect and the denuded bone. Complete wound closure was achieved with 6/0 monofilic material using horizontal mattress and interrupted sutures (Fig 5). Care was taken for tension free sutures.



**Fig 8** - 12 months follow up. The midbuccal recession, important for the esthetics, increased only about 0,5 mm over 12 months.

### Postoperative maintenance

For postoperative pain control and to prevent swelling of the gingival tissues the patient took 500 mg paracetamol twice daily for the first three postoperative days. The patient was recalled at day two, seven and fourteen after surgery. During the first two weeks the patient rinsed twice daily with a 0,2% chlorhexidine solution. Two days after the surgery the patient started to clean the wound very carefully with a surgical tooth brush tipped in a chlorhexidine solution. No further oral hygiene was performed in the surgical area for two weeks. All sutures were removed fourteen days post-op. Thereafter, the patient was examined at a three month interval. The patient was very cooperative. The plaque score during the first year was always below 10% (O' Leary PL I).

### Results

Wound healing was completely uneventful. Primary wound healing was already evident two days after surgery. At day seven after surgery soft tissue wound healing was nearly completed (Fig 6).

Six months after surgery the probing depth (PD) and the attachment level were measured for the first time. The PD had decreased midbuccal from 7,4 mm to 4,2 mm, at the distobuccal site from 5 mm to 4 mm. This reduction was maintained over the 12 month control period on both sides. Moreover, the attachment gain of 4,2 mm six months after surgery could be maintained over the complete follow up period.

The midbuccal recession, important for the esthetics, increased only about 0,5 mm over 12 months (Fig 1 and 8). Therefore, it was decided to keep tooth 13 and to fabricate a new and esthetically better fixed bridge.

### Conclusion

Wide intrabony defects can effectively be treated with Straumann® Emdogain PLUS in combination with periodontal surgery. Indeed, early primary wound healing can be readily observed. No healing complications like flap dehiscence, often associated with membranes, were found.

The support of the soft tissue through Straumann® Emdogain PLUS helped to completely fill the great bony defect and to prevent postoperative recession in an esthetically very important zone. Furthermore, the regenerative properties of Straumann® Emdogain led to the regeneration of the periodontal attachment in the former intrabony defect.

## SINUS FLOOR AUGMENTATION WITH STRAUMANN® BONECERAMIC (CASE 1)



Dr. med Dr. dent Andres Stricker  
Oral Surgeon  
Private practice, Constance/Germany

### Clinical case by Dr. Andres Stricker

The most important evidence for the suitability of an osteoconductive bone substitute for Guided Bone Regeneration (GBR) can be found in a histological analysis. It is the measuring criteria for any results pertaining to bone regeneration. Apart from the osteoconductive properties of bone substitute materials, good volume stability and exceptional handling are of equal importance when discussing sinus floor augmentation. The choice of a procedure as well as the healing period is, to a large degree, dependent upon the residual bone height and the addition of autogenous bone.

### Aim of the procedure

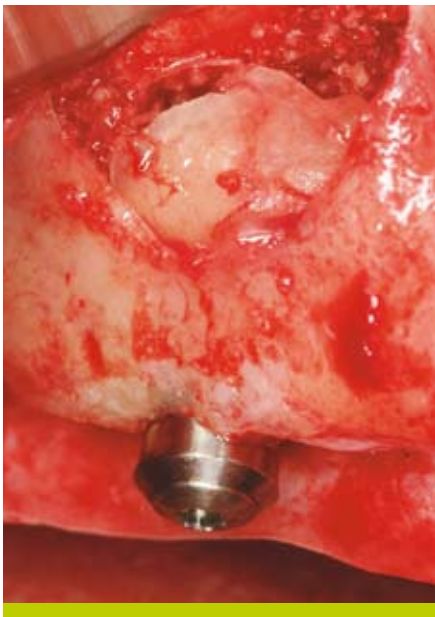
Elevation of the Schneiderian membrane for bone augmentation at the primary stable implant located in the posterior maxilla.



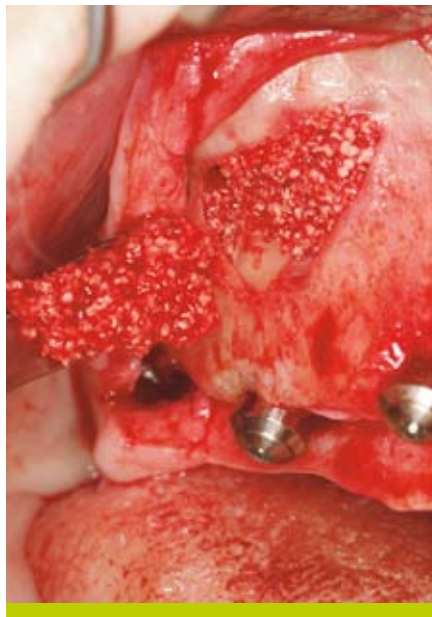
**Fig 1** - Lateral approach after detaching the bony lid. The Schneiderian membrane is easily visible.



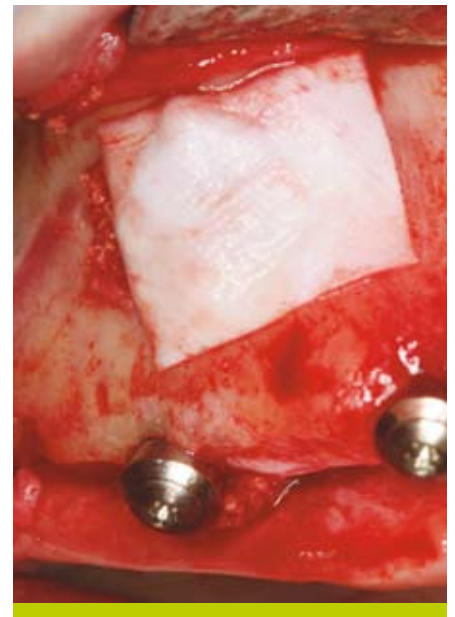
**Fig 2** - Straumann® BoneCeramic is applied through the lateral window mesially distally and palatally to the implant in the subantral space. The implant is placed primary stable.



**Fig 3** - Particles of bone harvested from the Tuber region are covering the implant surface.



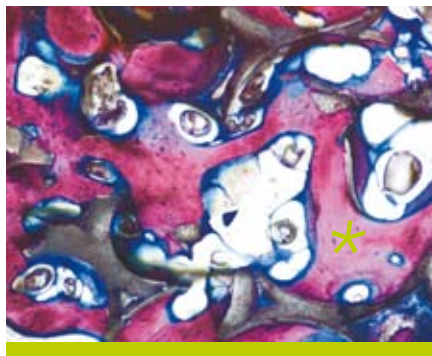
**Fig 4** - The remaining space to be augmented is filled to the bone wall with Straumann® BoneCeramic. The excellent adhesive properties of the granulate facilitates easy handling.



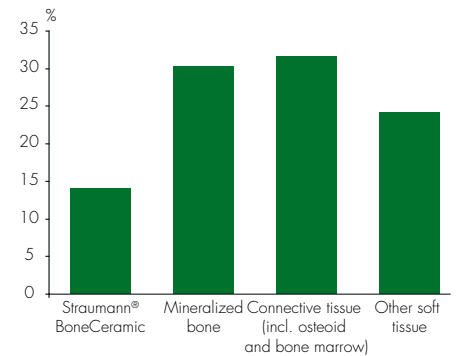
**Fig 5** - The lateral window is covered with a membrane to protect the grafted defect from soft tissue ingrowth, and to prevent dissemination of graft material. The soft tissue flap can now be repositioned.



**Fig 6** - The postoperative radiograph shows the augmented sinus floor and the inserted Straumann implants.



**Fig 7** - Histological specimen of another clinical case of a sinus floor augmentation, where implant placement was done six months after the augmentation procedure. Straumann® BoneCeramic (dark colouring shown in the corresponding Fig) is well integrated into the bone structure. The trabecular architecture of the bone corresponds to the natural structure of the native bone. Clear signs of bone maturity with lamellar bone are evident (\*).



**Fig 8** - Histomorphometrical analysis six months after augmentation shows a high ratio of mineralized bone tissue.

## Practical considerations based on Dr. Stricker's Case

### Residual bone height determines the operative procedure

#### Variable approach

- Residual bone height is less than 3 mm: Primary stability can not be guaranteed. There is danger of micromotion of the implant with the resulting inadequate osseointegration.
- Residual bone height is between 4 and 8 mm: Simultaneous implant placement.
- Residual bone height is more than 8 mm: An internal sinus lift using an osteome technique can also be employed.

#### Mixture with autogenous bone

„I prefer a 50/50 mixture of Straumann® BoneCeramic with autogenous bone, when dealing with minimal residual bone height. For the most part I use an autogenous bone graft from the retromolar or the tuber region. When dealing with larger residual bone height I reduce the amount of autogenous bone to approximately 20% to cover the implant surface“ (Dr. Stricker).

#### Healing period with the two-stage approach

„Depending on the residual bone height and mixture with Straumann® BoneCeramic and autogenous bone, I adhere to a healing period frame of four to six months prior to implant placement“ (Dr. Stricker).

#### Elevation of the Schneiderian membrane

After mobilization of the soft tissue flap with a palatal cutting technique and a mesial relief incision the lateral wall of the sinus floor is reflected. Afterwards, removal of the bony lid to prepare for a lateral approach starts by using a cutter and drill. Careful detachment of the Schneiderian membrane palatal with a sinus lift instrument is the next step. The bony lid is then mobilized apically into the intact Schneiderian membrane. On the one hand, it provides the source of the bone cells, which will grow into the augmented space via the osteoconductive surface. On the one hand, the bony lid eases the stabilization of the autogenous material.

Straumann® BoneCeramic has excellent absorption properties for blood and is very simple to apply. It is delivered in a unique double blister packaging. This allows the granules to be moistened within the package. The particular triangular shape facilitates removal of the wetted granules. In this regard, using Straumann® BoneCeramic is very user-friendly

#### Prosthetic Restoration

Implant loading will usually take place four to six months after implant insertion.

## SINUS FLOOR AUGMENTATION WITH STRAUMANN® BONECERAMIC (CASE 2)



*Dr. Christoph Hesse  
Oral surgeon  
Private practice, Dachau/Germany*

### **Clinical case by Dr. Christoph Hesse**

#### **Preparation of the window**

An incision is made directly along the alveolar ridge. This facilitates primary wound closure as well as preventing wound dehiscence and necrosis. The subsequent detachment of the bony lid is first achieved with a round bur until the Schneiderian membrane becomes visible. The final detachment is done with diamond round burs. Sinus elevators are used to carefully detach the Schneiderian membrane prior to the application of Straumann® BoneCeramic into the subantral space. The bony lid may be inserted into the subantral space. On the one hand it helps elevating the Schneiderian membrane. On the other hand, it serves as a source for bone cells to infiltrate into the defective area along the surface of Straumann® BoneCeramic.

#### **Healing period of the staged approach**

In general, the insertion of implants into the augmented region should be related to an increase in radio-opacity. In the above case by Dr. Ch. Hesse, implant placement was possible 15 weeks after bone augmentation. According to Dr. Ch. Hesse's experience, addition of autogenous bone reduces the healing time when compared to the application of Straumann® BoneCeramic alone. In cases where a particularly bad bone quality is present, a longer healing period may be required. When Straumann® BoneCeramic is used by itself in a staged approach a healing time of 6–9 months is recommended, depending on the residual bone height.

#### **Loading the implant**

Implant loading in the augmented sinus floor is normally performed three months after implant placement.

#### **Sinus floor augmentation using osteotomes**

Osteotomes can be used for augmentation in case of a residual bone height of more than 5 mm.



**Fig 1** - Pre-operative radiograph showing a bilaterally pneumatized sinus. The residual bone height is approximately 2 mm. Teeth 17 and 18 are scheduled for extraction.



**Fig 2** - The lateral access to the sinus was achieved by removing a bony lid with a diameter of approx. 7 mm. The Schneiderian membrane is visible.



**Fig 3** - Straumann® BoneCeramic is placed in the subantral space.



**Fig 4** - Radiographic image right after bilateral augmentation of the sinus floor. The augmented areas of Straumann® BoneCeramic are clearly visible.



**Fig 5** - Formation of new tissue is evident 15 weeks postoperatively through an increase of radio-opacity at both augmented sites.



**Fig 6** - Straumann® Standard implants are inserted 15 weeks after augmentation. Clinical situation after primary wound closure.



**Fig 7** - Clinical situation after primary wound closure.



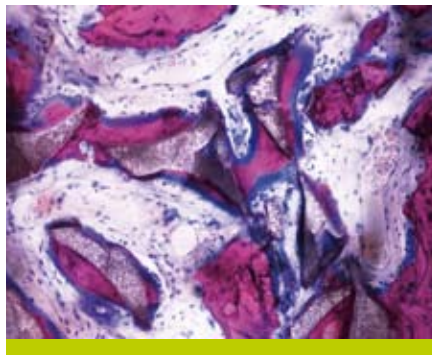
**Fig 8** - Right posterior maxilla. Clinical situation with the final restoration 12 months after surgery.



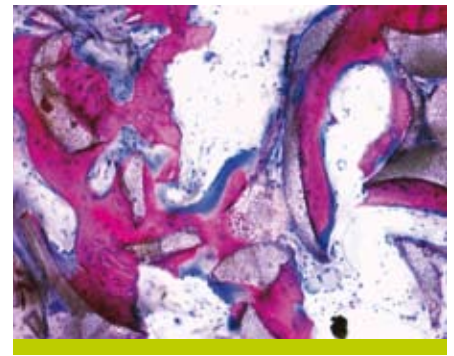
**Fig 9** - Left posterior maxilla. Clinical situation with the final restoration 12 months after surgery.



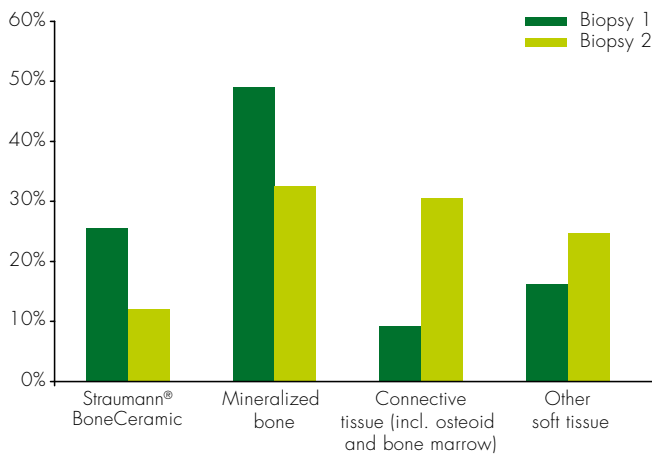
**Fig 10** - Radiograph 12 months after implant placement indicating the position of the implants and the stabile volume of the augmented site.



**Fig 11** - Biopsy 1: Straumann® BoneCeramic particles are covered with new bone. Bone formation, evident by osteoid (blue coloured).



**Fig 12** - Biopsy 2: Bone is formed along the surface of Straumann® BoneCeramic particles. Distinct layers of osteoid can be seen.



**Fig 13** - Histomorphometric evaluation of the biopsies demonstrate good bone formation after a healing time of 15 weeks.

## RIDGE PRESERVATION FOLLOWING TOOTH EXTRACTION FOR LATER IMPLANT PLACEMENT WITH STRAUMANN® BONECERAMIC (CASE 1)



Barry P. Levin, DMD  
Specialist in  
Periodontics and Implant Dentistry  
Elkins Park, PA  
Associate Professor  
Dept. of Periodontics  
University of Pennsylvania/USA

Aiming at primary stability for the implant as well as preservation of the alveolar ridge Straumann® BoneCeramic provides a resorbable scaffold that facilitates bone formation in the socket and supports the preservation of the buccal bone walls for later implant placement. However, making a decision regarding the healing period prior to implantation depends on the residual bone before augmentation.

### Clinical case by Dr. Barry Levin

#### Treatment aim

The purpose of the surgical procedure using Straumann® BoneCeramic lies in the prevention of predictable ridge resorption that follows extractions. The procedure will enable an ideal, prosthetically driven implant placement in 4–6 months.

#### Prerequisites

This surgical procedure is an option in cases where the possibility of immediate placement is contraindicated. One common example can be found where proximity of the inferior alveolar canal or the maxillary sinus precludes immediate placement. Inadequate bone, for achieving primary stability, or acute infection, extending into the potential osteotomy site, make up other important reasons.



**Fig 1** - Fresh sockets after extraction of mandibular molars. The immediate placement of implants is not indicated due to missing primary stability.



**Fig 2** - Filling of the sockets with Straumann® BoneCeramic 500–1000 µm. Note: The yellow colour originates from the tetracycline added. In almost all cases, augmentation is carried out at the same time as extraction. In the case of a severe infection at the time of extraction, a healing period of about 4 weeks may precede augmentation, to allow for resolution of the infective process and achieve healthier soft tissue.



**Fig 3** - Covering of the augmented site with a collagen membrane.



**Fig 4** - Primary wound closure.



**Fig 5** - After a healing period of five months the soft tissue is healed showing keratinized gingiva.



**Fig 6** - Healed hard tissue at re-entry five months after augmentation.



**Fig 7** - Straumann® implants with SLActive surface placed. Both implants are 4,8 mm x 10 mm wide neck; standard plus (WN;SP).



**Fig 8** - Primary wound closure.



**Fig 9** - Radiographic picture reveals stable hard tissue situation three months post implant-placement and 12 months after grafting procedure.



**Fig 10** - Histological specimen shows vast bone formation (pink colour) nine months after augmentation and some residual Straumann® BoneCeramic particles (purple).

## Practical considerations based on the procedure used by Dr. Levin

### Removal of granulation tissue

In order for the procedure to succeed, thorough removal of granulation tissue is of the highest importance. Following extraction, all PDL remnants and granulation tissue must be removed. This is accomplished by sharp excavators and curettes. Tenacious granulation tissue is sometimes removed with the accompanying use of ultrasonic instruments and rotary instrumentation in a high-speed handpiece. According to Dr. Levin, after a visual inspection of the “clean” socket, burnishing of the socket walls with tetracycline paste is done for about one minute. This step is performed in order to take advantage of the substantivity of tetracycline, to bind to the walls of the socket and possibly exert bacteriostatic properties to augment the regenerative process.

### Timing of implant placement

An implant can be immediately placed, as long as the implant can be set in the ideal position with primary stability. There are situations, where soft tissue conditions are not favourable, due to inflammation or infection or when no keratinization of the gingiva is present. In such cases it is advisable not to go for immediate placement.

The appropriate healing period before implant placement also depends on the amount of native bone in the extraction socket at the time of extraction. According to Dr. Levin, if the future implant site consists of at least 50% pre-existing bone, then a waiting time of 3–4 months after augmentation is recommendable. At that point in time, the new bone is still quite active with bone maturation in an early formative stage. However, if the future implant site is composed mainly of augmented material Dr. Levin will typically wait about six months. When active bone maturation is the goal at implant placement, the hardness of the bone may not yet have reached its final stage. Thus, for early re-entries (< 6 months) or larger augmentation procedures, the appearance of hard tissue in some cases may be a little soft. An effort is then made not to disturb the shape of the healing site. The implant is placed as planned, with as little trauma as possible. This does not affect the success rate with Straumann® SLActive implants placed in the augmented bone.

Dr. Levin has placed between 40 and 50 implants in extraction sites grafted with Straumann® Bone Ceramic. “To date I haven’t lost any implant in these areas” (Dr. Levin).

### The buccal bone plate

According to Dr. Levin, in augmented sites little or no buccal resorption can be found. “Especially in the anterior region, it is not uncommon that even in an augmented site resorption of the buccal plate occurs.

In these cases an additional augmentation on the buccal aspect of the implant is indicated. I will do this to either repair a minor dehiscence or fenestration and/or build a thick (2–3 mm) buccal plate for long-term soft tissue maintenance.”

### Primary wound closure

When soft tissue quantity is low in the maxillary sites, Dr. Levin obtains tension free wound closure by rotating a soft tissue pedicle graft from the palatal flap, and sutures this pedicle to the buccal flap over the resorbable membrane. In mandibular sites a membrane is used for protection of the graft. Occasionally, if membrane coverage is insufficient (3–4 mm), a dermal allograft is utilized for slower resorption and protection of the graft from the oral cavity.

### Using Straumann® BoneCeramic

Dr. Levin is quite clear about his preference: “I prefer 500–1000 µm particle size in extraction sockets. I pack the graft making an effort not to over condense the graft, but to avoid large voids within the socket.”

Moreover, using a membrane without a bone substitute is not an alternative: “It is not predictable that the pressure exerted on a healing site from the overlying flap, lip and or cheeks will not cause at least partial collapse of the membrane into a non-grafted socket. Additionally, if one of the walls of the extraction socket is partially or mostly destroyed by either the previous infection or osteotomy related to tooth removal, it is virtually impossible to support a membrane in an optimal configuration without an underlying bone graft” (Dr. Levin).

## RIDGE PRESERVATION FOLLOWING TOOTH EXTRACTION FOR LATER IMPLANT PLACEMENT WITH STRAUMANN® BONECERAMIC (CASE 2)



*Dr. Robert Nieberler  
Oral Surgeon  
Private practice, Puchheim/Germany*

### **Clinical case by Dr. Robert Nieberler**

#### **Treatment aim**

The treatment aims at the preservation of the dimensions of the alveolar process through limitation of buccal bone resorption. As a result, a basis can be provided for implants with primary stability as well as an optimal soft tissue esthetic.

#### **Requirements**

The procedure is indicated only in cases where an acute infection has not been diagnosed. A simultaneous approach to placing an implant at the same time as the augmentation procedure is preferable, when the implants can be inserted with primary stability. Moreover, this must also be acceptable from the standpoint of soft tissue quality and quantity.



**Fig 1** - X-ray shows heavy bone resorption at tooth 35 and 36 caused by a vertical root fracture of tooth 36.



**Fig 2** - Clinical situation after tooth extraction with a buccal bone deficiency. Primary stability for an implant is not present. First, a bone augmentation must be done.



**Fig 3** - Straumann® BoneCeramic 400-700 µm in situ.



**Fig 4** - Prior to the primary wound closure, the augmentation material is covered with a teflon membrane. With this type of membrane complete closure of the mucoperiosteal flap was not necessary. The membrane was removed four weeks postoperatively.



**Fig 5** - Nine Months after surgery a completely healed keratinized gingiva can be seen.



**Fig 6** - The reopening nine months post-op exhibits a volume stable alveolar ridge.



**Fig 7** - Straumann® Standard implants in situ.



**Fig 8** - Wound closure.



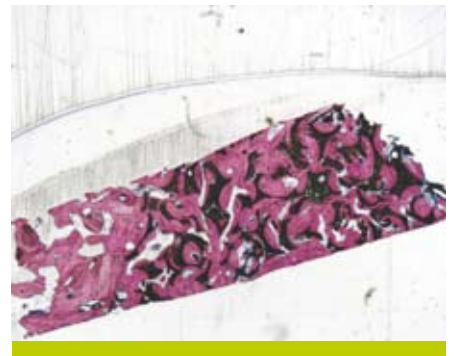
**Fig 9** - Radiograph 12 months post-op exhibits osseointegrated implants and a stable alveolar ridge height.



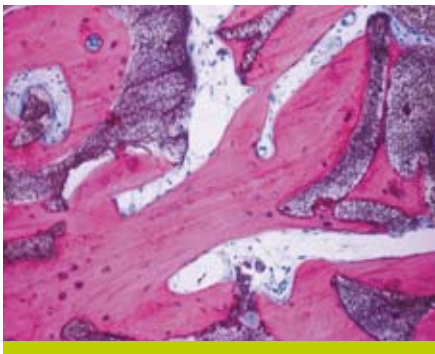
**Fig 10** - Excellent soft tissue esthetic before beginning prosthetic restoration.



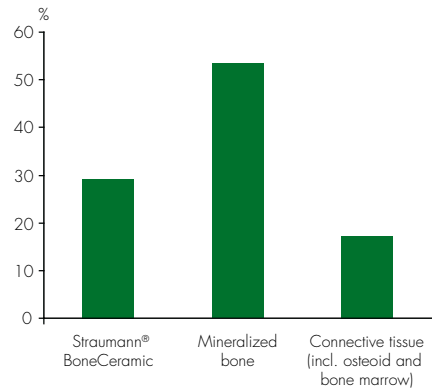
**Fig 11** - Final prosthetic restoration. (Done by Dr. Hilbert, Fürstenfeldbruck; Dentallab-Bauer, Fürstenfeldbruck)



**Fig 12** - Large area bone development nine months after surgery over the entire pre-preparation (red color = mineralized bone; dark color = Straumann® BoneCeramic particles). The histology shown here was derived from a different clinical case than the one shown above.



**Fig 13** - Enlarged view shows a natural trabecular bone and a well osseointegrated structure with Straumann® BoneCeramic particles.



**Fig 14** - The histomorphometrical analysis clearly shows a high proportion of newly formed mineralized bone.

## Practical considerations based on the procedure implemented by Dr. Robert Nieberler

### In which cases is an augmentation advisable after tooth extraction?

- Thin buccal osteon
- Periodontal bone loss
- Removal of expanded cysts with resulting unsatisfactory primary stability for an implant
- After root resorption
- Vertical longitudinal fracture
- Tooth loss during growth period
- Root fractures
- Endodontic lesions

### At what point in time, immediately after a tooth extraction, can an augmentation be done?

Prerequisite for a bone augmentation is an alveolar socket that is free from infection.

"In case of infections as well as after cyst removal and a strongly reduced buccal bone wall, I adhere to a healing period of three months before bone augmentation." (Dr. Nieberler)

### Time of implantation and prosthetic restoration

My experience with Straumann® BoneCeramic regarding "socket preservation" and approximately 20 implants placed since 2005, without the loss of one single implant, confirms the following approach:

Time of implantation 6–9 months after augmentation: Whether after six or nine months I don't see any relevant resorption of the buccal bone plate. Regarding the implantation after six months, the bone can be a bit softer. However, this does not contradict a complete osseointegration and implant stability. At this point in time, the bone is generally much more active. After nine months the bone has completely matured, which is confirmed by a histomorphometrical analysis taken from a biopsy (Fig 14).

### Preparations during surgery

"A complete removal of granulation tissue is essential for successful bone regeneration in the extraction alveolar. To this end I use a curette. Before I apply Straumann® BoneCeramic to the alveolar ridge, I fresh up the bone with a drill.

After filling in the bone substitute, I cover the granulate with a membrane and close the soft tissue flaps. If a tension-free wound closure is not possible, then I use either a soft tissue graft or a free mucosal graft." (Dr. Nieberler)

### Simultaneous or two-stage procedure?

"For me, an intact alveolar socket is decisively important. In this case, I place an implant directly after extraction, filling the space between implant and bone wall with Straumann® BoneCeramic, which takes care of stabilizing the buccal wall as well as filling the approximal space with bone." (Dr. Nieberler)

## LATERAL BONE AUGMENTATION AND SIMULTANEOUS IMPLANT PLACEMENT WITH STRAUMANN® BONECERAMIC



*Dr. med. dent. Anton Friedmann,  
Institute for Periodontology and Synoptic Dentistry  
Universitätsmedizin Charité Berlin/Germany*

### **Clinical case by Dr. Anton Friedmann**

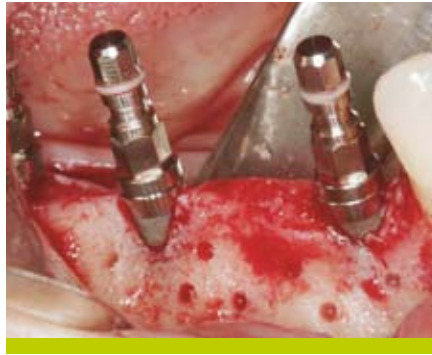
Reliable and volume stabile bone augmentation is achievable by using a bone substitute, which features optimal resorption properties. However, the surgical approach will also influence the clinical result.

#### **Treatment aim**

The treatment aims at the establishment of an adequate alveolar ridge profile with stable soft tissue dimensions and a sufficient amount of keratinized gingiva around implant neck. On the basis of this, the application of grafting material in terms of a lateral augmentation at the same time as implant placement presented itself as the procedure of choice.



**Fig 1** - Clinical presentation some years after tooth extraction showing well healed soft tissue. The dark coloration is related to an amalgam pigmentation occurred years before.



**Fig 2** - After elevation of the mucoperiosteal flap, a buccal bone deficiency becomes evident. The primary-stabile Straumann® Standard Plus implants (RN) show a partly exposed SLA® implant surface.



**Fig 3** - Straumann® BoneCeramic 500–1000 µm is mixed in the blister with the patient's blood and can be applied afterwards quite easily to the defect region.



**Fig 4** - Straumann® BoneCeramic in situ. The adhesive properties of the material make its spatial arrangement around implants an easy and quick procedure.



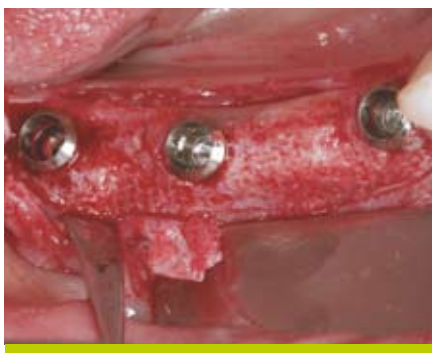
**Fig 5** - The grafting material should always be covered with a membrane before primary closure of the wound area is achieved.



**Fig 6** - Elevated healing abutments are installed to give additional support to the extra amount of soft tissue on the buccal aspect.



**Fig 7** - Keratinized gingiva nine months after surgery, is successfully retained around the implant necks, extending 1 to 2 mm from the implant shoulder.



**Fig 8** - Six months after implant placement together with the augmentation procedure, a solid newly formed lateral bone is visible. During second stage procedure, healing abutments are connected to the implants and the layer of soft tissue on the buccal aspect of the implants is thickened by means of rolled flap technique.

## Practical considerations based on Dr. Anton Friedman's approach

### Stabile bone volume

For the preservation of the augmented alveolar ridge, an optimal resorption process of the bone substitute can be advantageous. On the one hand, the bone substitute should stabilize the bone volume built up in an initial phase on the buccal side. On the other hand, it should be replaced gradually by newly formed bone, ideally by means of physiological bone remodelling.

### Stimulation of the osseointegration

Apart from the choice of an appropriate bone substitute, it is important to pay attention in connection with the surgical procedure to providing the best conditions for the growth of new bone into the defective region. To this end, the bone marrow space should be exposed. The cortical plate of a chronic defect is perforated with a round bur. An acute defect without compact bone does not require any further work. Furthermore, Dr. Friedmann removes all the granulation tissue using such mechanical instruments as a curette or with back action chisels (according to Ochsenbein).

Dr. Friedmann: „In cases with this indication, I generally do not mix autogenous bone with Straumann® BoneCeramic. Exposed implant surfaces can, if necessary, be covered with drill chips in a first step, before a second layer of Straumann® BoneCeramic is applied.

### Primary wound closure

Dr. Friedmann: “In order to achieve primary wound closure at the time of implant placement I follow a delayed approach, in which a soft tissue healing period of six to eight weeks is allowed. Splitting the periosteum then allows for a tension-free primary wound closure at the time of implant placement”.

### Indispensible membrane application

Dr. Friedmann: „In an indication like this, the application of a membrane barrier is undoubtedly justified. Apart from stabilizing the inserted granulate, growth of soft tissue cells into the defect region is prevented. This provides for undisturbed bone formation. In my opinion, the periostium is not an alternative to a barrier membrane. A successful augmentation results in an increase in volume. Because of this, the surgeon will not be able to avoid a radical splitting of the periostium to achieve primary wound closure. Thus, the periostium will not be able to function as a completely effective barrier”.

The clinical case presented here outlined the suitability of Straumann® BoneCeramic in the buccal bone augmentation in primary stabile implants. In this way ideal bone contouring can be achieved.

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