

# Horizontal Ridge Augmentation Using Titanium Tenting Screws Followed by Implant Placement

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## Abstract



**M**any bone grafting methods have been proposed to reconstruct maxillary or mandibular edentulous ridges. The amount of resorption influences the outcome of any regeneration technique. Siebert classified ridge defects according to their morphology and severity.<sup>1</sup> The "Siebert classification" has helped standardize communication among clinicians in the selection and sequencing of reconstructive procedures designed to eliminate the classified defects. In addition to this classification, other factors (Table 1) should be included in considering the appropriate surgical technique.

In a systemic review by Fiorellini and Nevins,<sup>2</sup> it was reported that implants placed in sites treated by guided bone regeneration (GBR) had a survival of  $95.8\% \pm 5\%$  at  $56.5 \pm 25.5$  months. The span of the edentulous ridge and the amount of attachment on the neighboring teeth had significant impact on the predictability of the chosen surgical approach. It should be noted in this regard that a mean horizontal width of 3.5 mm can be expected following alveolar ridge augmentation techniques.<sup>3</sup> This case report presents the surgical reconstruction of a maxillary edentulous segment prior to implant placement.

**KEY WORDS:** Ridge augmentation, bone graft, dental implants

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**Figure 1:** Occlusal view of the maxillary right premolar area.



**Figure 2:** Facial view of the maxillary right premolar area.

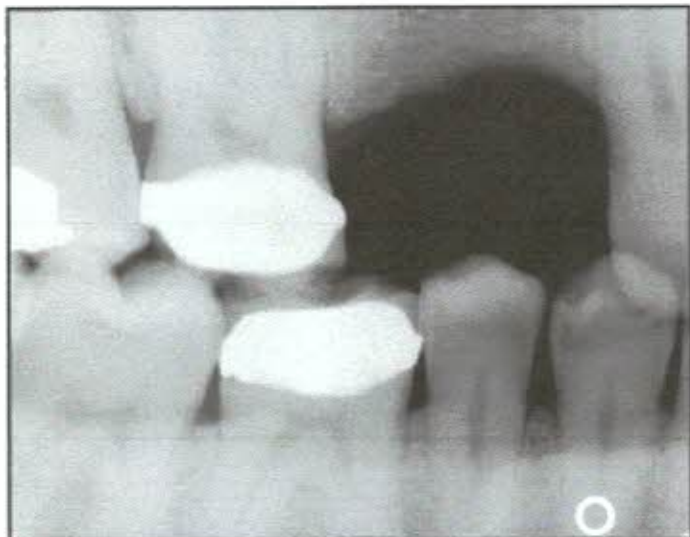
## INTRODUCTION AND BACKGROUND

Over the past two decades, many bone augmentation procedures have been proposed with a variety of factors that must be considered (Table 1). These procedures are intended to address and augment an edentulous ridge in a horizontal and/or vertical fashion. Sinus lifts are intended to augment pneumatized sinuses prior to or at the same time of implant placement.<sup>4, 5</sup> Ramus and chin block graft are becoming more predictable and are typically employed to reconstruct a ridge that lacks in the horizontal and/or vertical dimensions.<sup>6</sup> Split ridge osteotomies are used to increase dimensions of an edentulous ridge in a horizontal dimension.<sup>7</sup> The development of barrier membranes resulted in the technique of GBR. The concept of a barrier membrane was first tested in the late 1950s and early 1960s by using Millipore filters in the healing of orthopedic bone defects. In the early 1980s the potential

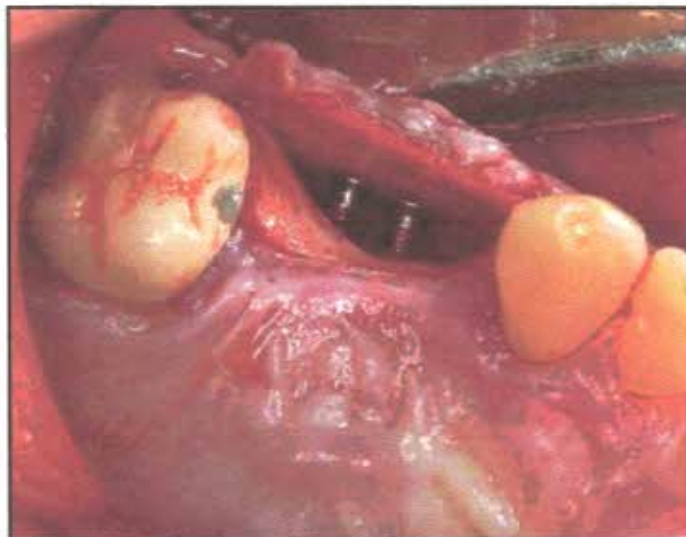
of the barrier membrane technique was recognized by a Scandinavian research team, who systematically determined the relative contribution of different tissues to the healing of periodontal structures in various experimental and clinical studies.<sup>8, 9</sup> The Scandinavian studies lead to the evaluation of barrier membranes for the regeneration of bone defects in the edentulous jaw. Two types of membranes could be used to achieve that purpose, non-resorbable membranes and resorbable membranes. Unlike the resorbable membrane, the non-resorbable membrane requires an additional surgery to remove the barrier. The basic reason for using a membrane (resorbable or non-resorbable) is two-fold: 1) exclusion of epithelium; and 2) provide and maintain space to allow for regeneration of bone.<sup>10</sup>

## CASE REPORT

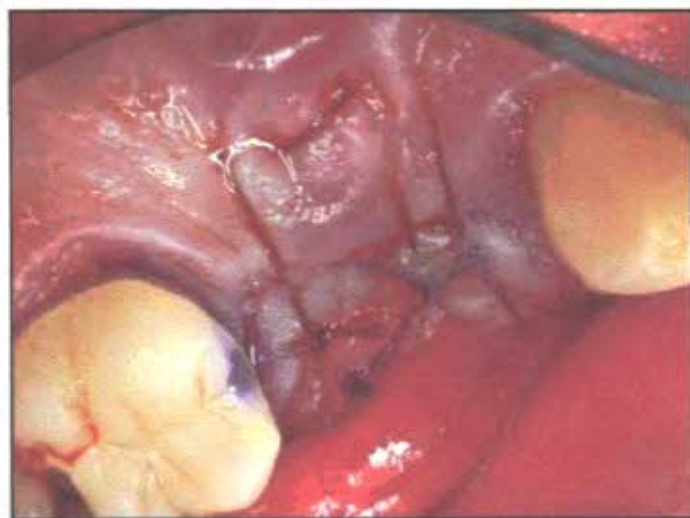
A healthy 48 year-old male presented to the Graduate Periodontics Clinic at the University



**Figure 3:** Radiograph of the maxillary right premolar area showing lateral profile of edentulous alveolar ridge.



**Figure 4:** Collagen membrane secured in place over the tenting screws immediately prior to placement of particulate bone grafting material.



**Figure 5:** Primary closure attained.



**Figure 6:** Edentulous alveolar ridge following tenting screw removal and immediately prior to preparation of osteotomies showing significant horizontal bone regeneration.

of Missouri Kansas City for implant placement. Approximately 5 years previous to presentation, the patient had lost the maxillary right bicuspid teeth (#4 and #5) due to non-restorable car-

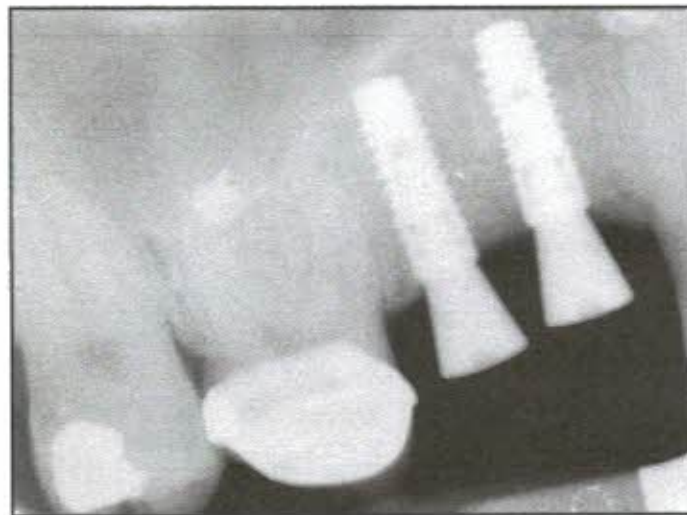
ies. The patient's medical history was unremarkable. An 18-film full-mouth radiographic survey was taken and a comprehensive oral examination and consultation was conducted.



**Figure 7:** Osteotomies prepared.



**Figure 8:** Implants placed and flap closure.

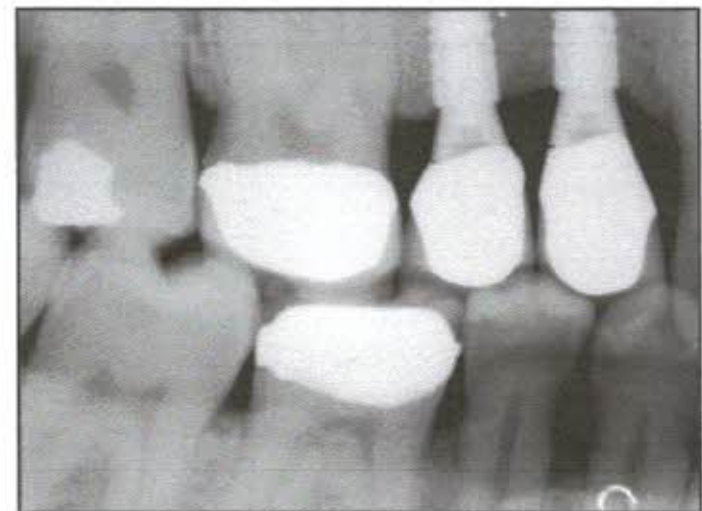


**Figure 9:** Immediate post-implant placement radiograph.

The patient stated that bone was removed at the time of extraction in order to facilitate removal of the hopeless teeth. As a result the edentulous ridge was deficient in the horizontal dimension (Figs. 1 & 2). In addition, the ridge showed minor resorption in the vertical dimension (Fig. 3). Due to the multidimensional resorption pattern the edentulous ridge was classified as a Siebert Class 3. The treatment consisted of hori-



**Figure 10:** Two-week post-implant placement.



**Figure 11:** Bitewing radiograph September 2014.

**Table 1: Factors Influencing Treatment Plans**

<b>Systemic</b>
Significant medical history of systemic disease and medications. Systemic disease risk factors with the potential to impact surgical result.
<b>Behavioral &amp; Psychological</b>
Smoking, Stress, Anxiety, Oral Hygiene, Patient Compliance, Mental Illness (e.g., Depression, History of or Active Substance Abuse, Dental Phobia, etc.)
<b>Periodontal &amp; Endodontic Status</b>
Active Disease or History of Periodontal Therapy, Current Periodontal Status, Oral Hygiene, Patient Compliance to Periodontal Maintenance, Pulpal Health of All Remaining Teeth
<b>Preliminary Restorative Considerations</b>
Diagnostic Casts, Diagnostic Wax-up, Radiographs and/or CBCT, Established Restorative Treatment Plan Prior to Initiating Site Development and Dental Implant Therapy
<b>Anatomic and Surgical Site Factors</b>
<i>Maxillary Surgical Site</i>
Esthetic Zone: Smile Line and Gingival Display, Ridge Resorption (Seibert Classification), Facial Bone Concavities, Facial-Palatal Alveolar Bone Thickness, Interproximal Bone Level of Adjacent Teeth, Bone Quality, Width and Thickness of Keratinized Tissue, Location and Thickness of Frenulum
Sinus Augmentation: Access, Direct Approach (lateral window or crestal) or Indirect (i.e., Sinus "Tap"), Presence of Septa, Thickness of Lateral Wall of Sinus, Presence of Intraosseous Arteries, Vertical and Horizontal Thickness of Edentulous Alveolar Bone, Width of Facial Keratinized Tissue
<i>Mandibular Surgical Site</i>
Access, Seibert Classification of Ridge Resorption, Presence of Lingual Undercuts, Proximity to Inferior Alveolar Canal and Mental Foramen, Facial-Lingual Alveolar Bone Thickness, Bone Quality, Width and Thickness of Keratinized Tissue, Location and Thickness of Frenulum

zontal ridge augmentation followed by implant placement to replace the two missing bicuspids.

Three carpules of 2% Lidocaine with 1:100,000 epinephrine and one carpule of 0.5% Marcaine™ (Hospira, Inc., Lake Forest, IL) with 1:200,000 epinephrine were administered by infiltration. Full thickness flap reflection was performed and the edentulous bony ridge was exposed. The existing buccal plate was decorticated<sup>11,12</sup> using a #2 round bur and three pilot-

holes for tenting screw placement were prepared in the buccal cortical plate. The pilot-holes were positioned in a tripod fashion with 3 mm of separation from each other. The tenting screws, OsteoMed™ Autodrive (OsteoMed, Addison, TX) self-drilling screws, 2 mm diameter x 10 mm length, were then inserted. A periosteal release was performed in order to ensure primary closure at the end of the procedure (Fig. 4). The next step involved using Puros Allograft® (Carls-

bad, CA) which was hydrated and then compacted into the area. A resorbable BioMend Extend® membrane (Zimmer Dental, Carlsbad, CA) was secured over the graft and titanium screws and the flap was primarily closed (Fig. 5) using Vicryl™ 4-0 sutures (Ethicon, Inc, Somerville, NJ). Amoxicillin 875 mg b.i.d., Vicodin 5/500 and Motrin 800 mg were prescribed. The post operative appointment was scheduled at 10 days. Healing was normal and uneventful.

At 5-months post-augmentation surgery, the patient presented for implant placement. Anesthesia was achieved by utilizing three carpules of 2% Lidocaine with 1:100,000 epinephrine and one carpule of 0.5% Marcaine™ (Hospira, Inc., Lake Forest, IL) with 1:200,000. A full thickness flap was elevated (Fig. 6), the tenting screws were removed and the osteotomies started (Figs. 7). Two SLA Straumann® bone level NC implants, measuring 3.3 x 10 mm, were placed. Adequate clearance was kept between the implants and between each implant and adjacent tooth.<sup>13,15</sup> Healing abutments were placed and the flap was replaced (Fig. 8). Periapical radiographs were taken to verify the angulation of implants and their proximity to the maxillary sinus (Fig. 9). The patient was given written and oral instructions and evaluated at 10 days post-operatively (Fig. 10). A bitewing radiograph was taken in September 2014 at the patient's periodontal maintenance visit (Fig. 11).

## CONCLUSION

Examination and classification of resorbed edentulous ridges is critical to the long-term prognosis of the rendered treatment. Throughout the past decades, many reconstructive surgical techniques have been developed in order

to rehabilitate those defects. Guided bone regeneration has proven to be a very predictable procedure as shown in this case report. ●

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### Disclosure

The authors report no conflicts of interest with anything mentioned in this article.

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