Maxillary sinus floor elevation using the (transalveolar) osteotome technique with or without grafting material. Part I: Implant survival and patients' perception.


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Abstract

OBJECTIVES: To analyze the survival and success rates of implants installed utilizing the (transalveolar) osteotome technique, to compare peri-implant soft tissue parameters and marginal bone levels of osteotome-installed implants with implants placed using standard surgical procedures, and to evaluate patient-centered outcomes.

MATERIAL AND METHODS: During 2000 to 2005, 252 Straumann dental implants were inserted in 181 patients. The surgical technique was a modification of the original osteotome technique presented by Summers. In addition to the clinical examination, the patients were asked to give their perception of the surgical procedure, utilizing a visual analogue scale.

RESULTS: The cumulative survival rate of the osteotome-installed implants after a mean follow-up time of 3.2 years, was 97.4% (95% confidence intervals: 94.4-98.8%). From the 252 implants inserted, three were lost before loading and another three were lost in the first and second year. According to residual bone height the survival was 91.3% for implant sites with < or =4 mm residual bone height, and 90% for sites with 4 mm and 5 mm, when compared with that of 100% in sites with bone height of above 5 mm. According to implant length the survival rates were 100% for 12 mm, 98.7% for 10 mm, 98.7% for 8 mm and only 47.6% for 6 mm implants. Soft tissue parameters (pocket probing depth, probing attachment level, bleeding on probing and marginal bone levels) did not yield any differences between the osteotome-installed and the conventionally placed implants. More than 90% of the patients were satisfied with the implant therapy and would undergo similar therapy again if necessary. The cost associated with implant therapy was considered to be justified.

CONCLUSION: In conclusion, the osteotome technique was a reliable method for implant insertion in the posterior maxilla, especially at sites with 5 mm or more of preoperative residual bone height and a relatively flat sinus floor.
**Transalveolar maxillary sinus floor elevation using osteotomes with or without grafting material. Part II: Radiographic tissue remodeling.**

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**Abstract**

OBJECTIVES: To evaluate the pattern of tissue remodeling after maxillary sinus floor elevation using the transalveolar osteotome technique with or without utilizing grafting materials.

METHODS: During the period of 2000-2005, 252 Straumann dental implants were inserted using the transalveolar sinus floor elevation technique in a group of 181 patients. For 88 or 35% of those implants, deproteinized bovine bone mineral with a particle size of 0.25-1 mm was used as the grafting material, but for the remaining 164 implants, no grafting material was utilized. Periapical radiographs were obtained with a paralleling technique and digitized. Two investigators, who were blinded to whether grafting material was used or not, subsequently evaluated the pattern of tissue remodeling.

RESULTS: The mean residual bone height was 7.5 mm (SD 2.2 mm), ranging from 2 to 12.7 mm. The mean residual bone height for implants placed with grafting material (6.4 mm) was significantly less compared with the implants installed without grafting material (8.1 mm). The implants penetrated on average 3.1 mm (SD 1.7 mm) into the sinus cavity. The measured mean radiographic bone gain using the transalveolar technique without grafting material was significantly less, 1.7 mm (SD 2 mm) compared with a mean bone gain of 4.1 mm (SD 2.4 mm), when grafting material was used. Furthermore, the probability of gaining 2 mm or more of new bone was 39.1% when no grafting material was used. The probability increased to 77.9% when the implants were installed with grafting material.

CONCLUSION: When the transalveolar sinus floor elevation was performed without utilizing grafting material, only a moderate gain of new bone could be detected mesial and distal to the implants. On the other hand, when grafting material was used, a substantial gain of new bone was usually seen on the radiographs.
Which hard tissue augmentation techniques are the most successful in furnishing bony support for implant placement?


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Erratum in:


Abstract

PURPOSE: A variety of techniques and materials have been used to establish the structural base of osseous tissue for supporting dental implants. The aim of this systematic review was to identify the most successful technique(s) to provide the necessary alveolar bone to place a dental implant and support long-term survival.

METHODS: A systematic online review of a main database and manual search of relevant articles from refereed journals were performed between 1980 and 2005. Updates and additions were made from September 2004 to May 2005. The hard tissue augmentation techniques were separated into 2 anatomic sites, the maxillary sinus and alveolar ridge. Within the alveolar ridge augmentation technique, different surgical approaches were identified and categorized, including guided bone regeneration (GBR), onlay/veneer grafting (OVG), combinations of onlay, veneer, interpositional inlay grafting (COG), distraction osteogenesis (DO), ridge splitting (RS), free and vascularized autografts for discontinuity defects (DD), mandibular interpositional grafting (MI), and socket preservation (SP). All identified articles were evaluated and screened by 2 independent reviewers to meet strict inclusion criteria. Articles meeting the inclusion criteria were further evaluated for data extraction. The initial search identified a total of 526 articles from the electronic database and manual search. Of these, 335 articles met the inclusion criteria after a review of the titles and abstracts. From the 335 articles, further review of the full text of the articles produced 90 articles that provided sufficient data for extraction and analysis.

RESULTS: For the maxillary sinus grafting (SG) technique, the results showed a total of 5,128 implants placed, with follow-up times ranging from 12 to 102 months. Implant survival was 92% for implants placed into autogenous and autogenous/composite grafts, 93.3% for implants placed into allogeneic/nonautogenous composite grafts, 81% for implants placed into alloplast and alloplast/xenograft materials, and 95.6% for implants placed into xenograft materials alone. For alveolar ridge augmentation, a total of 2,620 implants were placed, with follow-up ranging from 5 to 74 months. The implant survival rate was 95.5% for GBR, 90.4% for OVG, 94.7% for DO, and 83.8% for COG. Other techniques, such as DD, RS, SP, and MI, were difficult to analyze because of the small sample size and data heterogeneity within and across studies.

CONCLUSIONS: The maxillary sinus augmentation procedure has been well documented, and the long-term clinical success/survival (> 5 years) of implants placed, regardless of graft material(s) used, compares favorably to implants placed conventionally, with no grafting procedure, as reported in other systematic reviews. Alveolar ridge augmentation techniques
do not have detailed documentation or long-term follow-up studies, with the exception of GBR. However, studies that met the inclusion criteria seemed to be comparable and yielded favorable results in supporting dental implants. The alveolar ridge augmentation procedures may be more technique- and operator-experience-sensitive, and implant survival may be a function of residual bone supporting the dental implant rather than grafted bone. More in-depth, long-term, multicenter studies are required to provide further insight into augmentation procedures to support dental implant survival.

A systematic review of the success of sinus floor elevation and survival of implants inserted in combination with sinus floor elevation. Part II: transalveolar technique.

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Abstract

OBJECTIVES: The objectives of this systematic review were to assess the survival rate of implants placed in sites with transalveolar sinus floor elevation.

MATERIAL AND METHODS: An electronic search was conducted to identify prospective and retrospective cohort studies on transalveolar sinus floor elevation, with a mean follow-up time of at least 1 year after functional loading. Failure and complication rates were analyzed using random-effects Poisson regression models to obtain summary estimates/year proportions.

RESULTS: The search provided 849 titles. Full-text analysis was performed for 176 articles, resulting in 19 studies that met the inclusion criteria. Meta-analysis of these studies indicated an estimated annual failure rate of 2.48% (95% confidence interval (95% CI): 1.37-4.49%) translating to an estimated survival rate of 92.8% (95% CI): 87.4-96.0%) for implants placed in transalveolarly augmented sinuses, after 3 years in function. Furthermore, subject-based analysis revealed an estimated annual failure of 3.71% (95% CI: 1.21-11.38%), translating to 10.5% (95% CI: 3.6-28.9%) of the subjects experiencing implant loss over 3 years.

CONCLUSION: Survival rates of implants placed in transalveolar sinus floor augmentation sites are comparable to those in non-augmented sites. This technique is predictable with a low incidence of complications during and post-operatively.
Alveolar split osteotomy for the treatment of the severe narrow ridge maxillary atrophy: a modified technique.

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Abstract

Alveolar bone splitting and immediate implant placement have been proposed for patients with severe atrophy of the maxilla in the horizontal dimension. A new modification of the classical alveolar bone splitting for the treatment of the narrow ridge in the maxilla is provided. Thirty-three dental implants in eight consecutive patients were evaluated retrospectively following the described modified split-crest osteotomy. Inclusion criteria were: inadequate maxillary buccolingual dimension, 3-4mm of crestal width, and sufficient height from alveolar ridge tip to maxillary sinus floor. Primary stability was calculated using resonance frequency analysis (RFA). Alveolar bone height was measured in the panorex pre- and postoperatively. Histological bone examination was assessed following trephine bone harvesting during the second operation. Mean follow-up was 28.33 months. Bone regeneration of the inter-cortical gap occurred in 98% of implant sites (implant survival rate 100%). Mean implant stability quotient (ISQ) for the whole series of implants was 69.48. At the second operation, mean loss of the alveolar bone height was 0.542mm. Predictable results are obtained using the modified split-crest osteotomy. This technique provides an acceptable inter-cortical gap, decreases the risk of necrosis of the outer cortex, and provides a firm-wall box for the placement of particulate bone grafting.

Retrospective Clinical Evaluation of an Alternative Bone Expansion Technique for Implant Placement in Atrophic Endentulous Maxilla and Mandible.

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Abstract

Purpose: This clinical review is an evaluation of the effectiveness of the split ridge bone augmentation technique performed in the atrophic maxilla and mandible with buccolingual bony defects. The osseointegration success of implant placement in the area of split ridge bone augmentation is assessed and compared to implant success rates indicated by the literature. Materials and Methods: This evaluation includes 15 patients who were treated with alveolar split ridge bone augmentation at Tufts University School of Dental Medicine. During initial consultation, all patients were diagnosed with a buccolingual bone dimension of 3-5 mm on the endentulous alveolar crest. This bony buccolingual dimension was inadequate for placement of implants of desirable width and correct angulation as dictated by the prosthetic requirements. Crestal split augmentation technique involved a surgical osteotomy that was
followed by alveolar crest split and augmentation after buccolingual bony plate expansion, prior to implantation. Implants were placed either immediately or three weeks after the initial augmentation. No fixation was used to stabilize the buccal bony cortex after the completion of the augmentation. All patients were placed on periodical follow-ups for a 24 month period post-operatively. Implant success was determined with the use of Buser's Criteria. Results: In total, 33 implants were placed in 15 patients. The overall success rate of osseointegration of the endosseous implants placed in the area of split ridge bone augmentation was found to be 97%. One patient presented with facial bone resorption and implant mobility 4 months after the surgery. The implant was removed and the area was reconstructed with autogenous bone graft and later implanted with an endosseous implant. Conclusions: Our results indicate that the split crest bone augmentation technique is a valid reconstructive procedure that can be used to augment the buccolingual alveolar defect prior to implant placement providing good bone foundation for placement of implants with desirable width in favorable angulation. In comparison to traditional bone grafts techniques, crestal split ridge bone augmentation enables placement of dental implants immediately or three weeks after augmentation and eradicates the possible morbidity of the donor sites.

Resonance frequency analysis of stability on ITI implants with osteotome sinus floor elevation technique without grafting: a 5-month prospective study.


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Abstract

OBJECTIVE: The aim of the present study was to (1) monitor the stability changes of ITI implants placed in atrophic posterior maxillary ridges with osteotome sinus floor elevation (OSFE) without grafting during the first 5 months of healing utilizing resonance frequency analysis (RFA) and (2) determine the factors that affect the implant stability quotient (ISQ) at placement and healings.

MATERIAL AND METHODS: Forty-two ITI implants were placed in the posterior maxilla in 32 patients with OSFE without bone grafting. The residual vertical bone height ranged from 4 to 8 mm (average 6.36 mm). Bone type was classified into one to four groups according to the Lekholm and Zarb index. ISQ was tested on the day of surgery and consecutively at 2, 4, 6, 8, 12, 16, and 20 weeks by RFA.

RESULTS: The 40 osseointegrated implants represented a survival rate of 95.2%. All the 40 implants achieved good primary stability and reached a comparably high stability at 16 weeks postoperation with a dip between 2 and 6 weeks in the stability curve. There was no significant difference of ISQ between type3 and type4 bone at implant placement and follow-up. The mean ISQ and its changing pattern did not demonstrate a statistically significant difference according to the pretreatment vertical bone height and implant length.

CONCLUSIONS: The findings of this study indicated that uneventful osseointegration may be predictable applying OSFE alone with no grafting in atrophic posterior maxilla. Residual
bone height (RBH), implant length, and bone type did not seem to affect the implant stability in this clinical situation.

**Immediate and delayed lateral ridge expansion technique in the atrophic posterior mandibular ridge.**

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**Abstract**

PURPOSE: The lateral ridge expansion technique is used to expand the narrow edentulous ridge for implant placement. The staged approach can be used to split the mandibular ridge to decrease the risk of malfracture during osteotomy. The present study reports the clinical results of a surgical technique that expands a narrow mandibular ridge using an immediate and a delayed lateral expansion technique.

MATERIALS AND METHODS: A total of 32 patients with a narrow edentulous posterior mandibular ridge of 2 to 4 mm were included in the present study, and 84 implants were placed. Of the 32 patients, 23 were treated with an immediate lateral expansion technique and 9 with a delayed lateral expansion technique.

RESULTS: Of the 23 patients who underwent the immediate lateral expansion technique, a malfracture of the thin buccal cortical plate occurred during ridge splitting in 5 patients. All buccal segments of the 9 patients who underwent the delayed lateral expansion technique fractured as planned at the inferior horizontal corticotomy line favorably. After 4 to 5 months, all implants were stable and surrounded by bone, and ossification of the osteotomy line was obvious.

CONCLUSIONS: The lateral ridge expansion technique is effective for horizontal augmentation in the severely atrophic posterior mandibular ridge. The delayed lateral ridge expansion technique can be used more safely and predictably in patients with high bone quality and thick cortex and a narrower ridge in the mandible.
Interpositional bone grafting technique to widen narrow maxillary ridge.

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Abstract

A narrow edentulous alveolar ridge, less than 6 mm in the buccopalatal aspect, can prevent restoration by means of endosseous implants. A widening technique using alveolar ridge splitting and interpositional autogenous bone grafting is described. Accurate imaging of the alveolar bone shape and size was assessed with computerized tomography in a 1:1 scale. Following 6 months of healing, osseointegrated Brånemark implants were placed in the grafted sites.

Augmentation of the narrow traumatized anterior alveolar ridge to facilitate dental implant placement.


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Abstract

Traumatic tooth loss leads to alveolar resorption especially in sagittal direction. This can be due to avulsion of bone substance during the accident itself or due to resorption of the alveolar crest that takes place afterwards. Shortage of bone can prevent proper positioning of dental implants unless the volume of bone is increased before implantation. In the maxillary anterior area, this is also an esthetic problem. Several treatment modalities have been presented to augment the bone. This report reviews the latest literature on bone grafting, bone substitutes, guided bone regeneration, osteocompression and distraction which are potentially useful in the anterior maxilla. A special emphasis is paid to the versatility of using a crestal split osteotomy, by means of chisels and osteotomes to widen the narrow ridge. Three examples are illustrated showing onlay grafting, preservation of alveolar width with alloplastic coral material and lateral widening of a narrow maxillary alveolar ridge, using the crestal splitting technique.
Ridge-splitting technique with simultaneous implant placement.


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Abstract

Bone augmentation procedures are routinely required before dental implant placement. Several techniques for this procedure may be considered, such as guided bone regeneration, bone block grafting, and ridge splitting for bone expansion. These case reports describe the technique for ridge splitting and gradual expansion in the maxilla and the mandible. Simultaneously, dental implants were placed within the split ridge, surrounded by the particulate bone graft and covered by a resorbable membrane. Six months later, the implants were uncovered followed by impression and final restoration with implant-supported porcelain-fused-to-metal crowns.

Preliminary report on a staged ridge splitting technique for implant placement in the mandible: a technical note.

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Abstract

PURPOSE: Narrow edentulous alveolar ridges less than 5 mm wide require horizontal augmentation for the placement of screw-type dental implants. A staged approach to ridge splitting in the mandible to decrease the risk of malfracture during osteotomy is presented.

MATERIALS AND METHODS: Five consecutive patients with 6 long-span edentulous areas of the mandibular ridge were included in this study. After corticotomy of a rectangular buccal segment and a 40-day healing period, the mandibular ridge was split, leaving the buccal periosteum attached to the lateralized segment. Seventeen dental implants were placed, and the gap between the implants and the bone filled with a mixture of venous blood and a porous algae-derived hydroxyapatite.

RESULTS: All buccal segments fractured as planned at the basal corticotomy during ridge splitting. After 6 months, all implants were stable and surrounded by bone; prosthetic loading with fixed partial dentures was successful in all cases.

DISCUSSION: In the mandible, greenstick fracture during widening with osteotomes has not been controllable to date because of cortical thickness of the bone; the risk of malfracture during single-stage ridge splitting was high. With this approach, the location of the greenstick fracture is predetermined, and the perfusion for the buccal segment remains intact, although
vascularization shifts from internal perfusion from spongy bone after the first intervention to external perfusion from the periosteum after the second intervention. The buccal cortical segment remains a pedicled graft after ridge splitting.

CONCLUSION: The preliminary results of this report indicate that staged ridge splitting can be a safe technique which overcomes the problems associated with single-stage ridge expansion/ridge splitting procedures without causing significant delay in treatment.

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**Ultraschallbasiertes Knochenschneiden in der Oralchirurgie: eine Übersicht anhand von 60 Patientenfällen**

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**Zusammenfassung**


Ergebnisse: Die Piezoosteotomie erlaubte überaus präzise und glatte Schnitte, wobei es durch den Kavitationseffekt zu einer verbesserten Sicht auf das intraorale Operationsfeld kam. Sowohl die Blutungstendenz als auch die akzidentelle Verletzung von angrenzenden Weichgewebsstrukturen war während der Piezoosteotomie minimal. In diesem Zug konnten neben der papierdünnen und sehr verletzlichen Kieferhöhlenschleimhaut auch Nerven in der Umgebung der Osteotomiestelle geschont werden. Im Vergleich zum konventionellen Bohrer war die Traumatisierung deutlich reduziert. Postoperativ kam es nach 2, 14, 30 und 90
Tagen zu keinen Wundheilungsstörungen oder anderen ultraschallbedingten Komplikationen. Insgesamt war der Zeitbedarf für die Osteotomien im Vergleich zum Bohrer aber länger.


The segmental ridge-split procedure.

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Abstract

This report details surgical procedures for ridge expansion by means of splitting the crest of an edentulous ridge. Atrophic bony ridges present a unique challenge to the dental implant surgeon. In the past, onlay grafts of bone harvested from the hip, maxillary tuberosity, symphysis of the chin, or external oblique ridge have all been used with success in reconstruction of atrophic ridges. However, bone onlay grafting procedures require a secondary surgical site, which exhibits typical postoperative morbidity associated with bone harvesting performed with chisels and burs. Additionally, onlay grafts often require a healing period of 6 months to a year before dental implants can be placed, and the onlay graft sometimes fails to fuse to the augmented site. The segmental ridge-split procedure provides a quicker method wherein an atrophic ridge can be predictably expanded and grafted with bone allograft, eliminating the need for a second surgical site.
[Splitting and widening of a narrow jaw ridge in the edentulous maxilla]

[Article in Dutch]

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Abstract

One of the most frequently occurring problems in oral implantology, especially in the maxilla, is the reduction of the alveolar ridge, caused by bone resorption in the edentulous and partly edentulous maxilla. A usually successful but clinically sometimes complicated way of solving this problem is the augmentation of the resorbed parts of residual ridges, particularly when autologous bone is being used. Implant placement usually follows in a later stage. The bone-splitting and bone-widening technique, on the other hand, is a more obvious method for the immediate placement of implants in those cases where the dimensions of the residual ridge are reduced by only some degree. When the resorption of the residual ridge is extreme, this method can eventually be combined with guided tissue regeneration. Crestosplit instruments are specially developed osteotomes for cleaving and widening the crest of the residual ridge, whilst, at the same time, compressing the cancellous bone. In applying this procedure, a bone preparation can be made with dimensions very close to the diameter of the implant to be placed, and without losing important bone-parts as in the case of drilling. Upon the completion of this procedure, only the last drill with the dimensions of the implant has to be used and the implant can thus be placed in the same session. In edentulous cases where the resorption is almost nil, bone preparation with the aid of this method is also to be preferred as the compression of the corticocancellous bone will considerably increase the bone contact with the implant surface. Especially in the maxilla this will lead to a better prognosis of the survival rate of the implant and to better esthetic results of the final prosthetic restoration.

[Care of maxillary anterior gaps with ITI-Bonefit implants]

[Article in German]

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ZWR. 1991 Dec;100(12):928-30.

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Abstract

As for the Implantation in the upper frontal jaw region ITI-Bonefit-Implants show konceptional advantages to other systems. Surgical and prosthodontic techniques are demonstrated. In cases of extreme transversal atrophy segmental bone-splitting mostly makes implantation possible. First results from the dental clinic of Göttingen show a primary success rate of 100% in osteointegration and sufficient prosthodontic reconstruction.