

Dental Implants and Onlay Bone Grafts in the Anterior Maxilla: Analysis of Clinical Outcome

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Purpose: Loss of alveolar bone in the anterior maxilla may preclude implant placement or compromise positioning and thus diminish the final esthetic result of the restoration. Bone augmentation can overcome such difficulties but may affect osseointegration. The aim of this study was to report the outcome of buccal onlay bone grafting in the anterior maxilla in routine dental implant practice. **Materials and Methods:** Seventeen consecutive patients (12 men and 5 women, mean age 31.4 years) received autogenous bone grafts from the mandibular symphysis to the anterior maxilla. A total of 35 Brånemark System MK II implants were placed in grafted bone. **Results:** Fifteen patients had a mean period of graft consolidation of 19.7 weeks (range 13 to 32 weeks). Two patients had simultaneous graft and implant placement; 1 implant failed to integrate in this group. This represents a survival rate of 97.1% of implants in functional loading after a mean follow-up period of 153.6 weeks from occlusal loading (range 74 to 283 weeks). **Discussion and Conclusion:** Mandibular block onlay grafts appear to be a predictable method for augmenting the width of the anterior maxilla prior to implant placement. (INT J ORAL MAXILLOFAC IMPLANTS 2003;18:238–241)

Key words: alveolar bone, bone grafting, endosseous dental implants, esthetics

Implant rehabilitation in the esthetic zone of the anterior maxilla represents a challenge to the clinician. Long-term functional tooth replacement is often not the main priority for the patient and the clinician, who are looking to achieve a high-quality esthetic result.¹ Esthetic “integration” involves correct positioning of the implant with regard to the buccopalatal direction to enable a suitable emergence profile of the prosthesis.² The ideal emergence profile is where the crown of the tooth emerges from the gingiva as in the natural situation. This not only makes the prosthesis appear more natural but also facilitates oral hygiene procedures.

Loss of teeth in the anterior maxilla results in resorption of alveolar bone from the labial aspect, leaving a palatally positioned alveolar ridge. This can adversely affect implant positioning and compromise the final esthetic result of the restoration. Teeth in the anterior maxilla are also at risk of traumatic loss and there may be concomitant bone loss resulting from the trauma or from surgical removal of roots. Unless implants can be placed immediately after extraction, patients may be left with less than the ideal bone support for the soft tissues and implants.

To optimize esthetic implant placement in the resorbed or damaged ridge, augmentation may be required. Autogenous bone grafts have optimal osteogenic properties,^{3,4} in comparison with allogeneic,^{5,6} alloplastic,⁷ or xenogeneic grafts.⁸ The main disadvantage of autogenous bone grafts is morbidity of the donor site.⁹ The amount of bone required at the prospective implant site often dictates the donor site, but to augment the anterior maxilla, the mandibular symphysis has been reported to provide adequate volume.¹⁰ In cases where there are minimal defects of alveolar bone that allow implant placement but do not provide full coverage in bone, guided bone regeneration techniques can be used.^{11,12} Bone substitutes can be added to provide a scaffold (osteoconduction), or osteopromoting factors (osteinduction) can be used.

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Fig 1 Bone is harvested from the mandibular symphysis. Note holes perforating the cortical plate.



Fig 2 Trimmed graft is fixed in place to augment the anterior maxillary alveolus.



Fig 3 Exposure of graft at 21 weeks. Resorption is assessed by noting the position of the fixture screws and the new cortical plate.



Fig 4 Placement of implants in augmented ridge.

The success of osseointegrated implants has been well established by means of long-term clinical trials on ideal patients.¹³⁻¹⁶ There have been preliminary reports of implants in grafted bone in the anterior maxilla.^{10,17,18} The aim of this study was to analyze the survival of endosseous dental implants when placed into grafted bone in the anterior maxilla.

MATERIALS AND METHODS

The study group comprised 17 consecutive patients who had undergone bone grafting from the mandibular symphysis to the anterior maxilla to enable prosthetic rehabilitation with dental implants and had proceeded to prosthetic loading.

Bone grafting surgery was carried out under intravenous sedation or general anesthesia. Following a full-thickness incision in the mucosa of the mandibular labial vestibule from canine to canine, a

mucoperiosteal flap was reflected to reveal the mandibular symphysis.

Corticocancellous block grafts were harvested using an oscillating saw under saline irrigation (Fig 1). Particulate grafts were harvested by trephination and chipped using a bone mill (Leibinger, Botzinger, Freiburg, Germany). The cortical plate at the recipient site was perforated with multiple 1-mm-diameter drill holes, and the grafts were contoured to fit the residual bone (Fig 2); titanium screws (Leibinger) were used to ensure rigid fixation of the block (Fig 3). Membranes for guided bone regeneration were used in a few patients, depending on the amount of bone harvested and the requirements at the graft site. Simultaneous implant placement in the grafted bone was performed where there was adequate residual bone volume for primary stability; in the majority of cases, implants were placed after a healing period (Figs 4 and 5).

At second-stage surgery, implants were clinically assessed for integration by testing for mobility using percussion following manual tightening of the transmucosal abutment. Analysis of the survival of the loaded implant was used as the outcome measure. Completion of the initial planned prosthetic restoration and subjective esthetic evaluation were used to judge the success of the grafting procedure.

RESULTS

In the study group of 17 patients, 12 were men and 5 were women. The mean age at surgery was 31.4 years, with a range from 18 to 68 years. Three were smokers and 14 were nonsmokers. In addition, 1 patient had high blood pressure and 1 was asthmatic.

Nine patients required bone grafts to allow implant placement; 8 required bone grafts to enable esthetic implant placement. Two patients received simultaneous bone grafting and implant placement. The remaining 15 patients had a mean period of bone graft consolidation of 19.7 weeks (range, 13 to 32 weeks). Ten patients received corticocancellous block grafts and 7 had particulate cancellous grafts. Guided bone regeneration techniques were used in 4 patients. Nonresorbable Gore-Tex membrane (W. L. Gore, Flagstaff, AZ) was used in conjunction with 3 particulate grafts. In 1 block graft case where there was a defect between 2 blocks of bone, a resorbable membrane was used to cover the blocks (Bio-Gide; Geistlich Biomaterials, Wolhusen, Switzerland).

Four patients reported paresthesia at or around the donor site immediately following the graft surgery. There was a mean time period of 30.5 weeks between implant placement and abutment placement surgery (range 21 to 48 weeks). Occlusal loading followed after a mean of 18.7 weeks (range of 7 to 47 weeks). There has been a mean follow-up period of 153.6 weeks from the onset of occlusal loading (range 74 to 283 weeks).

A total of 35 Brånemark System Mark II implants (Nobel Biocare, Uxbridge, Middlesex, UK) were placed in grafted bone, a mean of 2.1 per patient (range, 1 to 4). One implant, in a patient who had undergone simultaneous bone grafting and implant placement, failed to integrate. This represents 97.1% of the implants that were loaded and survived the follow-up period. All but 1 patient, in whom the implant failed to integrate, proceeded to the planned prosthesis. The remaining 16 patients were restored as follows: 4 with single crowns, 7 with multiple crowns, and 5 with fixed prostheses. All of these patients were pleased with the final esthetic result achieved.

DISCUSSION

Long-term studies have shown a mean survival rate of 81% to 89% for maxillary implants¹³⁻¹⁵ and 91% to 99% for mandibular implants.^{13,14,16} These pioneering studies involved the implant rehabilitation of completely edentulous patients. Partially edentulous patients have been treated with similar success.^{19,20} More specifically regarding single-tooth implants, the majority of which were placed in the anterior maxilla, 97.8% survived the 3-year follow-up period.²¹ Reports of implants in grafted bone of the anterior maxilla compare favorably with the results of this study. A report of 10 implants placed in 9 patients, following a graft healing period of 3 to 5 months, revealed that 1 implant had not integrated at the time of abutment surgery.¹⁷ Another article reported on 27 patients with 31 maxillary implants placed after grafting with bone from a variety of intraoral sites, including the mandibular symphysis, with 100% success.¹⁸

To minimize exposure to ionizing radiation, in this study radiographs were only taken when clinically indicated and were not standardized. Therefore, the success of the implants as defined in the recent literature²² could not be analyzed. Radiographs taken prior to loading the implants and after 236 weeks of a patient used to illustrate the technique are shown in Figs 5 and 6.

The specific outcome criterion was that only patients who achieved functional loading were judged to be successful. By associating the success of the bone graft with osseointegration, the authors made the assumption that integration had occurred between vital bone and the implant. This assumption was presumed to be valid, because integration of implants tends to be categorical and therefore is not a subjective measure.

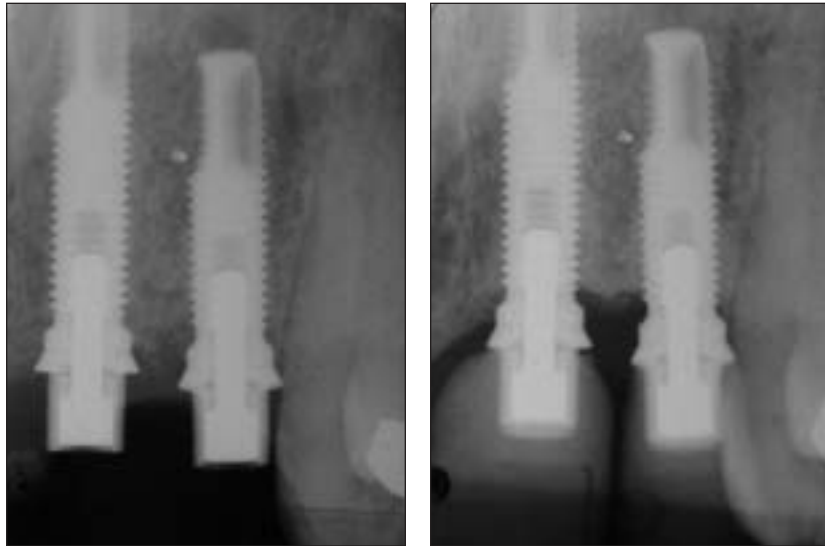
This investigation has reviewed the survival of loaded implants for a mean follow-up period of 153.6 weeks from the onset of occlusal loading. Although these data are short-term in comparison with some other implant trials, the follow-up has been longer than most reports dealing with implants in grafted bone. It has been demonstrated that implant failure often occurs either prior to abutment connection or in the early loading period; thus, results following functional loading are a good indicator of long-term success.²³

CONCLUSION

Autogenous mandibular bone grafts can provide a reliable method for augmenting the ridge width of the anterior maxilla prior to esthetic implant

Fig 5 (Left) Radiograph taken to check abutment connection just prior to occlusal loading.

Fig 6 (Right) Follow-up radiograph at 236 weeks after occlusal loading.



restoration. Bone grafting to the anterior maxilla enables implants to be placed where there has been insufficient bone and can improve the esthetics of the final restoration.

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