The introduction of endosteal implants has brought about a revolution in prosthetic dentistry in that implant-supported or implant-borne prosthetic devices have become the state of the art.

Pre-implant surgery is intended to enhance the peri-implant environment which may involve bone augmentation and soft tissue procedures. The principle aim is to create a favourable implant site for placement of endosteal implants of optimal size and position for optimal biomechanical function and aesthetics.

Pre-implant surgery is intended not only to improve the implant site per se but also to correct deficiencies in height and width of the alveolus and to restore or improve the intermaxillary relationship. This is because loss of bone in the edentulous jaw and, to a lesser extent, in the partially dentate jaw leads to an alteration of the maxillo-mandibular jaw relationship, encroachment of muscle attachments in relation to the edentulous alveolus and a decrease in the surface area of the overlying mucosa. The effect of these changes combined with ageing, circumoral hypotonia and collapse results in changes in facial form and appearance.

The successful application of endosteal implants depends on a favourable anatomical form and environment, biocompatibility and favourable long-term biomechanical conditions. There must be adequate bone volume both in height and width, to allow placement of implants of sufficiently large dimensions to withstand functional loading and permit optimal axial inclination to fulfil the functional and aesthetic requirements without interfering with adjacent anatomical structures – for example the neurovascular bundle, maxillary sinus or adjacent teeth. The implants should not impinge on or interfere with the function of the lips, tongue and floor of mouth. If the foregoing conditions do not prevail, pre-implant surgery including bone augmentation, soft tissue procedures and possibly an osteotomy should be undertaken.

The Clinician’s primary goal is to provide the patient with a satisfactory long-term functional and aesthetic implant-supported prosthesis based on the correct jaw relation. This requires optimal implant support and functional loading. The adage should therefore be: “let the patient fit the implant, not the implant fit the patient”.

Lundgren and Sennerby are much respected for their contribution to education, clinical practice and research both at the clinical level and at the bench level in the field of implant-related oral rehabilitation. Their systematic and objective studies have addressed many of the outstanding issues and provided answers, e.g. method for measurement of implant stability, timing of implant placement in bone grafted sites and timing of implant loading.

The authors also introduce the reader to new surgical techniques to augment the atrophic jaw, combining reduced surgical morbidity and improved treatment outcome. The novel combination of bone grafting and distraction osteogenesis offers exciting possibilities for the management of complex cases with severe interarch discrepancies.

Undoubtedly the authors are to be congratulated for this valuable addition to our knowledge base.

John I. Cawood
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ILiac Crest Bone Grafts

Treatment philosophy and background

Bone grafting is a commonly performed surgical procedure, particularly in the reconstruction of the atrophic edentulous maxilla, to enable placement and integration of endosseous implants. The iliac crest, the calvarium and the tibia are some of the sources of autogenous bone grafts which have been commonly described in the literature (Marx and Morales, 1988; Ellis, 1991; Tulasne, 1999; Marchena et al, 2002). The main advantage of using autogenous bone is related to the osteoconductive and osteoinductive capacities of the graft; the disadvantage is the use of an additional surgical site, with the risk of donor site morbidity. The anterior iliac crest is a commonly used donor site, especially when both cortical and cancellous bone are required. The medial or internal table of the ileum is often described in the literature as a preferable site owing to its ease accessibility and its low morbidity, especially when only cancellous bone is harvested. The medial table has a thin cortical plate compared with the superior or lateral border of the iliac crest. The area of the lateral iliac crest where the medial gluteus muscle inserts is called the tubercle, and the cortical bone has a high density and thickness. This area can be chosen when large amounts of cortical bone are needed. The disadvantage of harvesting bone from the superior or lateral border of the iliac crest is the interference with the insertion of the gluteus muscles and the inherent risk of gait disturbance. The harvesting of excessive amounts of bone from the superior or lateral part of the iliac crest can also result in a change in appearance of the hip contour.

In earlier studies on maxillary reconstruction with bone grafts and endosseous implants, it was found that implant length was a key factor for implant survival (Nyström et al, 1997). The chosen length of the implants was related to the available bone volume of the graft and recipient bone after the initial graft-healing process of six months. Bone resorption during the initial graft healing in the onlay or inlay/onlay reconstruction was also found to be very individual and unpredictable (Figs 1-1,2).

In some of the patients there was a strong resorption of the graft leaving limited available bone for the placement of the implants, which resulted in the use of short implants and insufficient initial implant stability (Figs 1-3,4). As a result, a few patients lost many of their implants (Lundgren et al, 1997). To overcome this problem, oversized grafts were harvested with a mainly cortical content to ensure that enough bone volume with sufficient density would be present during implant placement six months after initial graft healing (Figs 1-5,6). To obtain enough graft volume with sufficient cortical content, the lateral and superior area, instead of the medial aspect, of the anterior iliac crest was used for the onlay/inlay grafting (Figs 1-7,8).

The anteromedial approach is still the method of choice in interpositional grafting situations. With this technique the residual maxillary bone alone gives bicortical anchorage for the implants, and the interpositional graft only provides the necessary increase in bone volume.
Reconstruction of the atrophic edentulous jaw

Fig 2-100  Reconstructed bone at time of exposure for implant placement after three months of consolidation.

Fig 2-101  Six implants placed in the reconstructed bone.

Fig 2-102  Post-operative panoramic radiograph after the implant surgery.

Fig 2-103a  Post-operative profile radiograph with implants.

Fig 2-103b  Two-year follow-up with the temporary bridge in place. No sign of marginal bone resorption.

Fig 2-103c  Two-year follow-up profile radiograph.

Fig 2-103d  Final bridge, occlusal view.

Fig 2-103e  Final bridge, frontal view.
Combined bone grafting and horizontal osteodistraction

**Indication**
The combination of onlay grafting and horizontal distraction is indicated in the atrophic edentulous maxilla either in a Cawood and Howell Class IV (thin and high alveolar process in the anterior as well as the posterior maxilla) or a Class V (loss of vertical height in the anterior as well as the posterior maxilla) in combination with reversed intermaxillary relation, but without increased vertical intermaxillary distance.

**Grafting surgery**
The technique is identical to the technique described in combination with vertical distraction.

**Surgical technique for implant placement**
Six months after the grafting surgery, re-entry is performed under local anaesthesia. A midcrestal incision is made from the left to right second premolar area with a vertical releasing incision in the midline, and the fixation screws are removed with minimal reflection of the mucoperiosteal flap. Two implants are then placed in the anterior maxilla, and two to four implants in the posterior maxilla. The implants are placed with the help of a surgical guide, preferably two implants in the lateral incisor area and two implants in the second premolar area. Additional implants can be placed posterior to the first premolar area. It is important to place the anterior implants in a palatal position with a minimum of 3–4 mm of bone buccal to the implants as the resorption of the graft can be increased by the pressure from the mucosa during the later transport of the segment. Abutments are temporarily placed on the implants and an impression is taken. The abutments are removed and the implants are submerged for three months. A cast is fabricated from the impression and a custom-made distraction device is designed to enable the horizontal and vertical advancement of the anterior maxillary segment.

**Surgical technique for anterior maxillary osteotomy and horizontal distraction**
Three months after placing the implants, the patient is rescheduled for surgery under local anaesthesia and conscious sedation. After infiltration of local anaesthesia a midcrestal incision is performed from the left to right second premolar area with no posterior vertical incisions, only a vertical incision in the midline. The mucoperiosteal flap is reflected in the anterior maxilla and the nasal mucosa is reflected in the anterior nasal floor bilaterally. A vertical osteotomy in the alveolar process in the first premolar area is performed after tunnelation of the mucoperiosteal flap. Then the vertical osteotomy in the nasal floor is performed followed by the osteotomy of the palatal vault (Wassmund, 1935). The anterior maxilla is then down fractured. A periosteal incision is performed from above the palatal mucosa to eliminate the risk of vector change during the distraction and transport of the segment. The formed abutments are placed and the distraction device is fixed on top of the abutments. The incision is closed by single sutures (Figs 2-104–117).