

Case report

GRAFT OF THE ILIAC CREST AND TOTAL IMPLANT FULL-ARCH REHABILITATION: A CASE REPORT

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ABSTRACT

The purpose of this study was to assess changes in bone volume after the block bone increase and placement of dental implants and further assess the aesthetic outcome. This case highlights the success of implant osseointegration and aesthetic oral rehabilitation 5 months after the maxillary graft with a corticocancellous block obtained from the iliac crest. This article was conducted through a literature review based on international data. This study presents the case of a patient who benefits from this method of treatment, which leads to jaw reconstruction and dental implant placement. The postoperative evolution of the patient was favorable, with the integration collected from grafts of the iliac ridge and dental implant insertion. After the prosthetic loading, the masticatory and aesthetic function of the patient were restored. This jaw reconstruction method has proven effective, with a high degree of reliability and a significant improvement in patient's quality of life.

KEYWORDS: *bone regeneration, iliac crest graft, dental implants, maxillary reconstruction, full arch*

INTRODUCTION

Bone grafts are indicated in several cases: congenital and/or acquired defects, lack of teeth, post-traumatic resorption or loss of teeth, infections, and cancer. Due to inherent genetic, inductive, and conductive qualities, self-transplants present the best material for grafts (1). Although current literature indicates several suitable sites for explanting (jaw bone and extra-oral sources such as ribs, skull, and tibia), most authors prefer explanting bone from the iliac crest for four significant reasons:

1. abundance of both sponge and cortical bone, easily adaptable to implant site;
2. ease and subsequent speed of explantation;
3. the curvature of the iliac crest is very adaptable to the maxillary facial area;
4. infrequent diseases.

The loss of the teeth causes bone resorption of the jaw, creating aesthetic and rehabilitative problems. Important

Received: 16 March 2023

Accepted: 25 April 2023

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atrophies can compromise facial aesthetics, particularly in cases where the smile reveals an uneven rapport between arches (2). Moreover, in This case, a non-harmonious rapport between teeth and gums or a limited opening of the oral cavity renders hygiene difficult and causes several problems.

Over the years, numerous techniques for treating maxillary atrophies, using grafts and transplants, have been proposed.

In 1980, Breine et al. (3) were the first to study the effects of these procedures. Later, Mish et al. (4) corrected three-dimensional maxillary defects with explant and grafting of cortical bone from the anterior-medial area of the iliac crest to elevate the maxillary sinus. Mish et al. (4) obtained a 99% survival rate after 8 years with implants inserted in grafts. After that, many others successfully proposed auto-explants from the iliac crest, with or without the maxillary sinus elevation or subsequent implant insertion. This later research revealed that the procedure is safe (4).

TECHNIQUES

Deep incision explant

Many authors use this method when collecting large quantities of bone is necessary. The procedure requires the detachment of the gluteal muscles and the muscle of the medial hip wall (5). In the iliac crest, two incisions, one frontal and one posterior, are performed, followed by collecting bone. Undoubtedly, this procedure provides large quantities of bone; however, it is not free of important complications:

- abdominal hernias;
- bleeding;
- in situ e peritoneal vascular damage.

Worthy of note is the risk of fracture of the iliac crest and subsequent aesthetic problems. Several variants of this technique aim to limit muscle detachment and maintain the crest's conformation (6).

Lateral explants

This procedure requires the detachment of the gluteal muscles from the hip and four bone explants of a thinner section that may or may not interest the iliac crest (sub-crest). The surgery is relatively easy and rapid. Minor aesthetic problems are produced if the iliac crest is maintained. Postoperative pain, however, and impairment of deambulation are evident and long-lasting due to the detachment of the gluteal muscle and the tensor sideband. The risk of perforating the medial cortical hip wall and subsequent vascular damage, peritonitis, and intestinal fissures or occlusions should not be underestimated (7).

Medial explant

Similar to the lateral explant technique, the procedure involves postural muscles. The involvement of a postural muscle and not the gluteus (necessary for deambulation) makes many authors prefer this technique. Due to the minor adhesion of the periosteum compared to that of the lateral hip wall, the detachment of the postural muscles is easier. The same authors also report fewer complications, such as peritoneal bleeding, loss of sensibility, and aesthetic problems (8). They note that pain and deambulatory problems are less severe and require less recovery time. The theoretical risk of a lesion of the lateral femoral cutaneous nerve is possible because of its location on the medial iliac. The repositioning of both periosteum and abdominal muscles seems to reduce hemorrhaging and edema due to the pressure exerted by the intestines (9).

Bicortical explant with maintenance in situ of flat spongy bone

Periosteum and medial and lateral muscles are disassembled, and four osteotomies are performed on each side to isolate two specular bone blocks, leaving a spongiosa lamina in situ (10). This procedure leaves the iliac crest intact, even if reduced in size. Deambulatory problems remain because of the detachment of the periosteum and muscle. The risk of fracture of the remaining iliac crest, however, exists.

The oblique explant of only spongy bone segments from the crest and repositioning the crest without muscle detachment is another technique that avoids complications (11). The two incisions are divergent; one incision starts from the crest and is executed towards the bottom of the hip bone, and a second begins laterally and extends outwards. These two incisions allow the explant of marrow bone while maintaining the residual fragments of the crest, primarily cortical, integral through bone synthesis.

Explant of lateral cortical marrow bone

This surgical procedure calls for a crosswise, full-length incision of the hip bone starting laterally under the crest. This procedure leaves the bony cap crest attached to the periosteum and abdominal muscles. To effect the incision, scalpels, and spoons are required to explant the cortical marrow segment. After the explant, the crest is returned to its original position. The surgery facilitates access to the hip, reduces postoperative complications, and preserves the crest. The detachment of the gluteo muscle often compromises deambulation (12).

Explant of cortical marrow medial bone with rotation of medial crest

This procedure begins with an incision in the iliac crest membrane and continues laterally and medially to create a bony cap attached to the abdominal muscles. The cap is rotated to detach the membrane and the iliac muscle from the medial side of the ileum. A successive incision is made from a bone segment containing both cortical and marrow bone. This segment is shaped by cortical and marrow flaps (results of cortical hip disk) (13). The membrane and muscle are repositioned, and the iliac crest is repositioned and secured. This procedure, sparing the gluteal and abdominal muscles from detachment and sensibly reducing problems of postoperative pain and deambulation, provides large quantities of bone and preservation of the crest. According to several authors, this surgery also avoids the necessity of drainage as the entire area of the operation is closed.

The possible complications cited by the various authors are the fracture of the residual cortical bone and the subsequent formation of retroperitoneal bleeding and hematomas (14).

EXPLANT SURGERY: MONO-BICORTICAL EXPLANT

After sterilizing with iodopovidone, the operating site is delimited with sterile bandages, anesthesia, and vasoconstrictor infiltration (15).

An incision along the iliac crest is made for a length of 5-8 cm, starting at least 1 cm from the anterior point of the iliac crest and continuing toward the posterior iliac crest.

The subcutaneous incision includes the fascia lata and periosteum, using clamps to stop bleeding. The detachment of the periosteum exposes the explant site, giving particular attention to the iliac muscle.

The cortical bone segments are created with manual and oscillating saw blades, cutting the vertical incisions and then two parallel incisions to limit a box. The bone segment graft consists of the marrow section along the straight bone cuts. The segments should be stored in a physiologic solution before implantation. From the exposed area, spongy bone material can be collected using a surgical spoon. Intra-osseo bleeding is controlled with collagen sponges or shaped fibrin and, if required, orthopaedic wax.

After drainage placement, the suturing follows the anatomical levels inversely, starting at the periosteum and fascia lata using resorbable sutures and separate stitches. The suturing continues on the subcutaneous level with rapid absorption sutures and finally on the cutaneous level with separate or continuous stitches (16, 17). It is crucial to observe several parameters prior to the first incision (Fig. 1):

- a distance of 1 cm from the anterior point of the iliac crest to avoid damage to the inguinal canal and the insertion of the sartorius muscle;
- safety of the ileum-gastric nerve, assuring that it lays sideways on the crest;
- the length of the incision is proportional to the size of the explant, usually 5-8 cm; longer incisions must always follow the vertical direction.



Fig. 1. *Anesthesia and first incision.*

With adequate clamping, the lower-level incisions are executed. Without damaging the iliac and gluteal muscles, the periosteum of the crest is carefully detached from the lateral and medial sections of the hip. It is useful for performing wide divarication and tissue protection (Fig. 2, 3), followed by a manual evaluation of the graft (18).



Fig. 2. Photos showing detachment of muscle from the iliac crest.



Fig. 3. Photos showing and clamping of the iliac crest.

The osteotomy can be made with manual or oscillating saws below the crest. The area is then delimited with two incisions of the desired width perpendicular to the iliac crest and terminates with the caudal portion resection to free the flap from the surrounding bone. A surgical spoon can be employed in the exposed area if more marrow bone is necessary. The explanted segment is preserved in a physiologic solution. The crest fragments are recomposed with plates and screws. Vascular intra-osseo hemostasis is done with collagenous sponges and compressed, and when necessary, orthopaedic wax (Fig. 4, 5) (19).

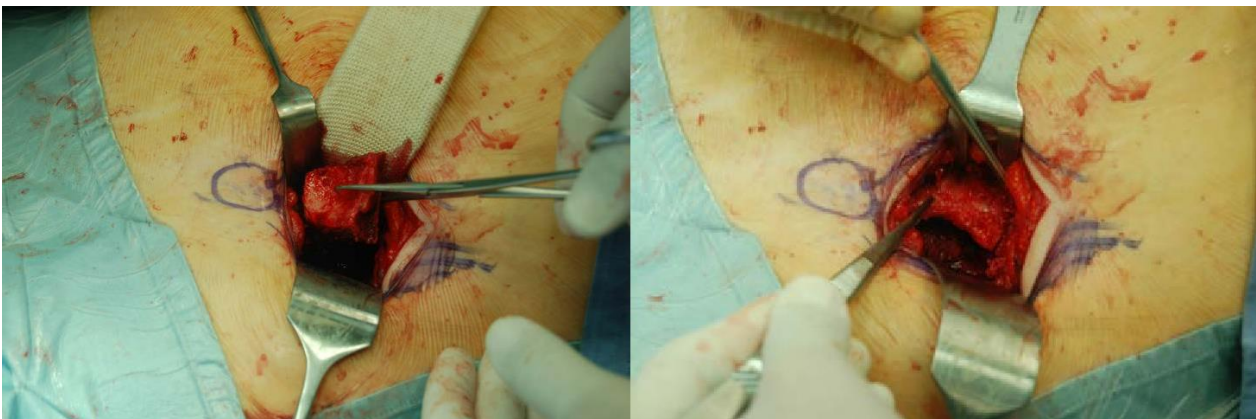


Fig. 4. Osteotomy and harvesting of the autologous graft.



Fig. 5. Osteotomy and harvesting of the autologous graft.

Before closing the exposed area, it is paramount to inspect accurately for bleeding to avoid complications; the suturing proceeds from the lowest level, periosteum and fascia lata, with separate stitches using slow absorption filament. The subcutaneous sutures should use rapidly absorbable filament (20). The cutaneous suturing can be either continuous or separate stitching, preferably intracutaneous, for better aesthetic results. After suturing, compressive dressing is removed after 24 hours, and ice packings are recommended.

Complications

Although relatively safe, this surgery carries both minor and major complications. The minor complications include pain, infections, accumulation of liquid, and difficulty walking (21). Among the severe complications are nerve and vascular damage, fractures, and hernias. The nerve damage usually interests three structures:

- the lateral branch of the cutaneous intercostal nerve;
- the lateral cutaneous branch of the iliohypogastric nerve;
- the lateral cutaneous femoral nerve.

This last complication generally occurs in those cases where the nerve is situated along the medial anterior iliac crest and below the inguinal ligament, even if in 2,7% of the cases, the nerve runs above the inguinal ligament. This position of the nerve increases the risk of nerve damage, which, if permanent, causes muscle pain.

Postoperative pain and difficulty in walking are to be expected (22). The return to normal deambulation varies with the size of the explant, and the pain may vary from a few days to 2 weeks.

BONE GRAFT OPERATION

Once the explant is completed, the subsequent step is grafting at the recipient site. After preparing the site with chlorhexidine and sterile cloths, anesthesia, and vasoconstrictors to control bleeding and postoperative pain, an incision is made along the mucosa (Fig. 6), extending it perpendicularly and outwards to the free mucous to detach the periosteum and expose the bone.

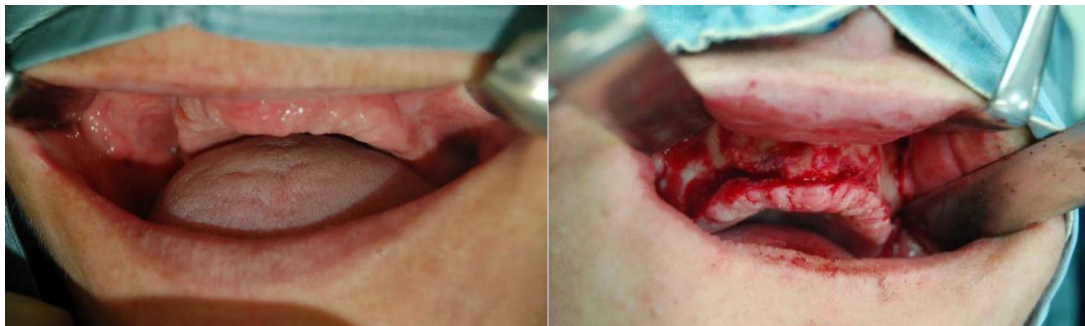


Fig. 6. Preparation of the maxillary site.

The graft is secured location using screws (Fig. 7). Sometimes, dividing the collected graft into smaller segments may be necessary to facilitate the reconstruction of irregular surfaces. Bone spurs and rough edges can be smoothed with a hand drill. The eventual spaces between the alveolar and the graft should be filled with spongy bone segments (23).

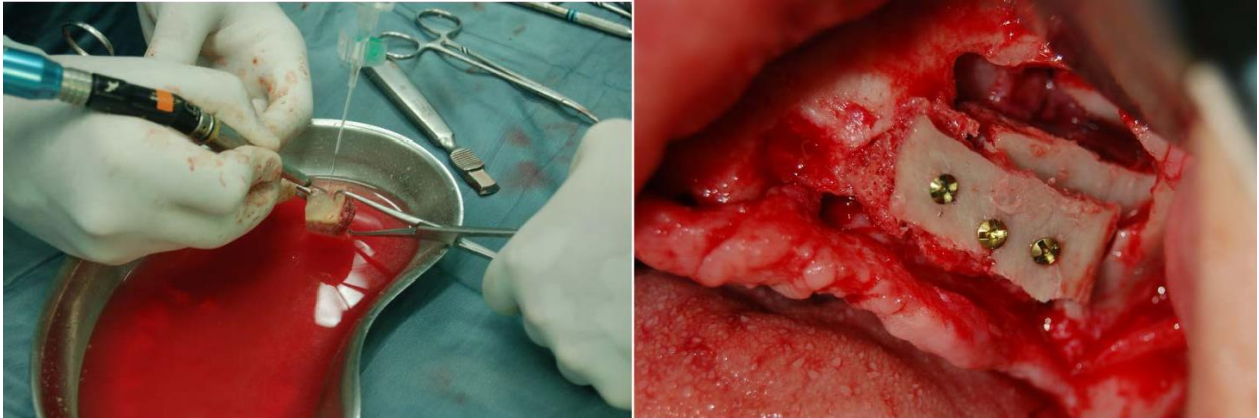


Fig. 7. *Modelling of bone graft and fixation with screw.*

Extending the incision to have sufficient tissue to close it may be necessary. The incision of the mucous membrane is closed with resorbable sutures (Fig. 8, 9) (24).



Fig. 8. *Suture of the flap and spongy bone in syringes.*

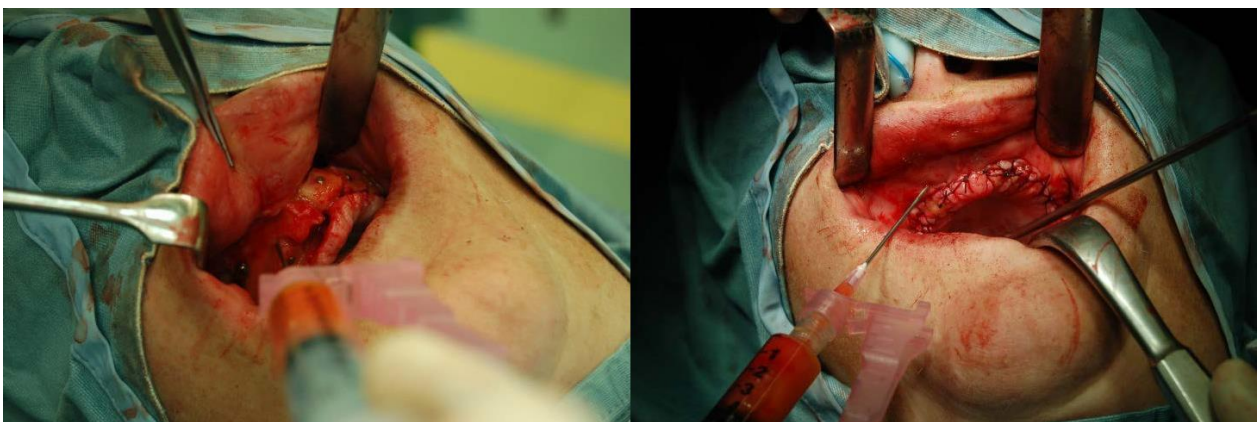


Fig. 9. *Suture of the flap.*

INSERTION OF THE DENTAL IMPLANTS

After 4 months without complications, the graft's integration and volume maintenance are verified with X-rays (Fig. 10, 11). In order to insert the dental implants, it is necessary to prepare a wax model and a surgical bite plate.

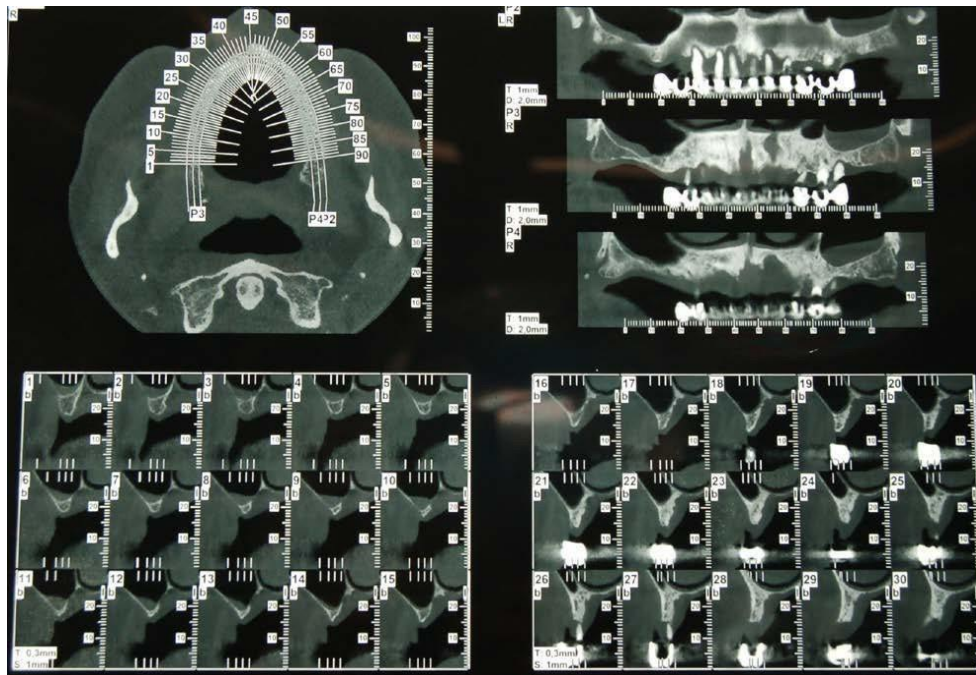


Fig. 10. Case 1: preoperative Tc Conebeam.



Fig. 11. Coronal section of CBCT, which demonstrated the fixed graft.

The insertion can be done in the dentist's office. The oral cavity is rinsed with a 0.20% chlorhexidine solution, followed by an anesthesia and vasoconstrictors injection. A flap of the muco-periosteum is lifted in the grafted area, and the screws used to fix the graft are removed. At the same time, it is useful to check the graft's consolidation and state of maintenance.

The implant site is prepared using a drill that increases the diameter and irrigates it with a physiologic solution. When the dental cavity is ready, the implant is screwed into place (Fig. 12) using a rotating instrument and finished manually. Before suturing, a plug screw should be used to protect the thread of the dental implant (25).

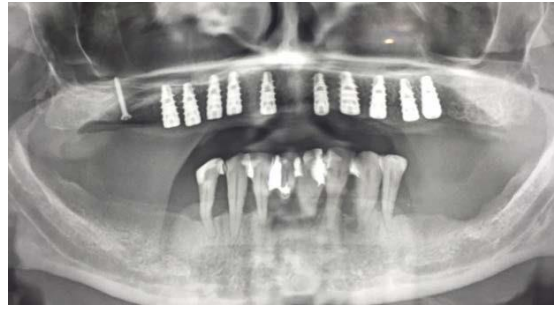


Fig.12. *Rx-Orthopantomogram postoperative with multi-implants inserted in graft.*

Healing and maturation of bone require about 3 months. The prosthesis phase can then begin. When the complete adaption of the peri-implant tissue and a satisfactory aesthetic result is reached, the procedure may be considered optimally terminated (26) (Fig. 13, 14).



Fig. 13. *Extra-oral view of full-arch rehabilitation.*



Fig. 14. *Intra-oral view of full-arch rehabilitation.*

CONCLUSIONS

Our case report and the literature review highlight that therapy for the reconstruction of important maxillary defects should be thoroughly studied and planned before selecting the best therapeutic options for each case. In our option, the most important parameters to consider are:

- the extension and form of the defect;
- the subsequent determination of the site to collect the graft;

We have not experienced a significant loss of bone graft volume during the healing process; therefore, iliac crest grafts are a valid and successful solution today.

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