

## **DONOR SITE MORBIDITY AFTER HARVESTING OF BONE FROM ANTERIOR ILIAC CREST FOR MAXILLOFACIAL RECONSTRUCTION**

Ahmed S. Naguib\*, Khalid A. Saad\*\* and Rafic R. Bedir\*

### ***ABSTRACT***

**Purpose:** Autologous iliac crest bone grafting is an integral part of many orthopedic surgical procedures. So, the purpose of this study was to determine the postoperative morbidity after harvesting graft from the anterior iliac crest.

**Patients and Methods:** This study was conducted on (10) adult patients comprised of (7) males and (3) females, their ages ranged from 13 to 45 years in Oral & Maxillofacial Surgery Department, Faculty of dentistry, Tanta University. An approval of the trust ethical committee was obtained together with a written informed consent from all patients. The donor site was evaluated according to: presence of pain, presence of gait, presence of numbness of the hip of the operated leg, presence of haematoma at the donor site, residual scar, deformity of the bony contour, scar tenderness and presence of wound dehiscence or infection.

**Results:** Patients spent a median of 1.5 days in the hospital. No pain had been detected at the end of the follow up period. All patients walked normally through the follow up periods except patient no. (8) who suffered from walking difficulty through the first month postoperatively but the condition improved after 3 and 6 months postoperatively. Only one patient (case no. 3) had numbness in the outer aspect of the operated leg through the 1<sup>st</sup> month postoperatively but the numbness had been disappeared after 3 & 6 months postoperatively. Only one patient, case no. (8) showed presence of haematoma and superficial infection through the 1<sup>st</sup> month postoperatively, but with conservative treatment the condition was improved through late follow up. One patient had reported presence of residual scar with tenderness on palpation (case no. 8) but tenderness had disappeared after 3&6 months postoperatively. No bony deformity had been detected in the donor site in all patients.

**Conclusion:** Harvesting of bone from the anterior iliac crest is well tolerated and had minimal morbidity.

\* Lecturer, Oral and Maxillofacial Surgery Dept., Faculty of Dentistry, Tanta University.

\*\* Associate Professor, Oral and Maxillofacial Surgery Dept., Faculty of Dentistry, Tanta University.

## INTRODUCTION

Harvesting of bone graft is a common procedure for promoting healing in a non-union fractures. The source of bone may be autogenous or an allograft from bone bank.<sup>(1)</sup>

Autogenous bone graft is considered as the gold standard solution for various reconstructive orthopedic procedures. Although many bone substitutes are available but autogenous bone have the advantages of being osteoinductive, osteoconductive and potentially osteogenic. Also the autogenous bone grafts have no concerns regarding to histocompatibility, immunogenicity, disease transmitting or high cost.<sup>(2)</sup>

In oral and maxillofacial surgery, the main indication for harvesting the iliac crest bone graft are secondary and tertiary osteoplasty for patients with cleft alveolus and augmentation of bony defects after operations for removal of cysts or tumors and augmentations for pre prosthetic surgery to manage the atrophic alveolar bone .<sup>(3)</sup>

Various donor sites have been used for autogenous bone grafts including ribs, calvarium, mandibular symphysis and iliac crest.<sup>(4)</sup>

The most common preferred donor site for obtaining autogenous bone grafts is the iliac crest. As the anterior iliac crest provides abundant volume of rich cellular cancellous bone, cortical bone and corticocancellous grafts. Also, it's relatively easy to harvest the graft and there is an ability to perform simultaneous oral procedures.<sup>(5)</sup>

Morbidity following harvesting from the iliac crest had been known in the orthopedic literature and 15% complications rate had been reported. However, techniques of harvesting i.e. by open approach or by minimally invasive trephine approach, the nature of the patient population and the amount of harvested bone graft all differs greatly between orthopedic and maxillofacial surgery.<sup>(6)</sup>

Several complications of bone harvested from the iliac crest had been known as chronic pain, nerve and arterial injury, sensory loss, contour defect, gait disturbance, peritoneal perforation, sacro-iliac joint instability, wound breakdown, seroma, haematoma, hemorrhage and herniation of the abdominal contents through defects in the ilium.<sup>(7)</sup>

However, the rate of complications following harvesting graft from the anterior iliac crest vary from study to study (6%-14.3%).<sup>(7)</sup>

So the aim of the present study was to assess the medium-term donor site morbidity after harvesting of bone graft from the anterior iliac crest.

## PATIENTS AND METHODS

This study was conducted on 10 adult patients, comprised of (7) males and (3) females, their ages ranged from 13-45 years with a mean of 28.7 years.

The surgery was done under general anaesthesia through nasoendotracheal intubation in Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Tanta University.

An approval of the trust ethical Committee was obtained together with written informed consent from all patients.

All operations were performed by a single oral & maxillofacial surgeon, with the same assistance team.

### Exclusion criteria included:

1. Patients who were aged < 7 years as these children were not be able to fill the visual analogue scale (VAS) correctly.
2. Patients who had performed previous iliac crest graft harvesting.
3. A history of congenital insensitivity to pain and learning difficulties.

The ten patients who had undergone to anterior iliac crest graft harvesting were evaluated according to the following parameters:-

1. Presence of pain: - through detection of the results by visual analogue scale.
2. Presence of gait disturbances.
3. Presence of numbness in the hip or the leg (operated site).
4. Presence of haematoma at the donor site
5. Presence of residual scar.
6. Presence of deformity of the bone contour of the hip: through plain radiographic examination.
7. Presence of scar tenderness.
8. Presence of wound infection

***Surgical technique for harvesting graft from the anterior aspect of the iliac crest:***

The patient was adjusted in a supine position, this allow simultaneous preparation of the recipient site.

A sand bag was placed under the ipsilateral buttock and standard site preparation was performed. Prophylactic antibiotics (Cephalosporin and Metronidazole) were given intravenously during induction of general anaesthesia.

A marking pen was used to mark the iliac crest and the anterior superior iliac spine (ASIS) was located. The area of the incision was infiltrated with Mepevacine 2% local anesthesia with 1/20000 Levonordefrin. The nonscalped bearing hand was used to displace the skin medially, placing the incision lateral to the iliac crest

The incision was made through the displaced skin directly over the crest along the bikini line. The limits of the incision not extending to within 1cm of the (ASIS) and the tubercle posteriorly. Fig. (1)

Then perform blunt dissection through the subcutaneous tissue to the insertion of the oblique fascia on the crest. Then incise the fascia and the underlying periosteum to expose a segment of the iliac crest.



Fig. (1) Showing the anterior iliac crest incision

The bone was harvested between the (ASIS) and the posterior iliac tubercle as here, there is greatest width within the ilium, facilitating obtaining of abundant cancellous bone amounts.

Harvesting of bone can be achieved by anterior and posterior stop cuts which were joined with a crestal sagittal cut with a small osteotome. A 10 mm osteotome was used to elevate the medial aspect of the cap, the osteotome was directed laterally to avoid the risk of peritoneal preformation. The corticocancellous bone block and the cancellous bone were harvested. Fig. (2)



Fig. (2) Showing corticocancellous anterior iliac crest bone block graft

Before closure, thorough irrigation was performed and meticulous hemostasis was obtained. A2-layer closure was performed to approximate the fascia and the subcutaneous tissues and a final layer of continuous running suture was used to approximate the skin. Skin tapes and a light pressure dressing were used.

### Postoperative care

Patients were encouraged to mobilize on the first postoperative day with support from the nursing staff and physiotherapy department. Patients were recommended to rest at home for two weeks and avoid contact sports for six weeks. Patients were given proper antibiotic cephalosporin 1gm every 12 hours for 1 week and pain-relieving medication voltaren 100 mg amp. Every 12 hours for one week. All patients were then reviewed after 1, 3 and 6 months after surgery. At these visits any complications and their progress were recorded. Their questionnaires were collected for analysis after their 6 months review.

### RESULTS

The mean length of stay in the hospital in all patients was 1.5 days. Out of the 10 patients included in this study, only two patients showed complications (patient no. 3 & no. 8). The patient no. (3) showed numbness over the lateral aspect of the thigh but the numbness resolved completely 6 months after surgery. The patient no. (8) showed haematoma at the operation site but this patient was treated conservatively with placing hot fomentation over the wound and giving a prophylactic antibiotic (1 gm Cephalosporine every 12 hours) to avoid occurrence of infection.

1. **Presence of pain at the hip donor site :** according to the results of (VAS), all patients showed mild pain after 1 month from surgery, while no pain had been detected at 3<sup>rd</sup> and 6<sup>th</sup> months postoperatively.
2. **Presence of gait disturbances:** all patients showed no gait disturbances through follow up periods except in patient no. (8) who showed

walking difficulty and required the use of a walking stick after one month from surgery but this patient was improved through the late follow up periods.

3. **Presence of numbness in the hip or the leg:** only one patient reported presence of numbness of the outside aspect of the thigh (in the operated side i.e. left side) patient no. (3) after 1 month from surgery but the condition was improved and no numbness had been detected at 3<sup>rd</sup> & 6<sup>th</sup> month postoperatively.
4. **Presence of haematoma at the donor site:** only one patient showed presence of haematoma at the operation site (case no. 8) after one month from surgery but the condition was disappeared through the late follow up periods.
5. **Presence of residual scar:** patients showed their satisfaction with the residual scar by using the visual analogue scale. (9) patients (90%) were very satisfied with their scar after six months postoperatively while only one patient (10%) case no. (8) was dissatisfied with the appearance of his scar.
6. **Presence of deformity of the bony contour of the hip:** radiographical examination postoperatively through the follow up periods showed presence of proper bone healing and no bony deformity had been detected at the iliac crest donor sites in all patients. Fig.(3)
7. **Presence of scar tenderness:** no scar tenderness had been detected in nine patients through follow up periods. Only one patient (case no. 8) showed scar tenderness after one month from surgery, but no tenderness had been detected after 3 or 6 months postoperatively in this patient.
8. **Presence: of wound infection:** all patients healed properly as shown through the follow up periods. Only one patient (case no. 8) showed presence of superficial infection at the wound site after one month from surgery but the condition was improved by I.V injection of antibiotics at 3<sup>rd</sup> month postoperatively.



Fig. (3) 1 month postoperative antero-posterior photoradiograph of anterior iliac crest donor site

## DISCUSSION

Uptill now. The iliac crest bone graft represents the gold standard site for taking graft for various reconstructive procedures as harvesting from the inner table of the anterior iliac crest provides sufficient quantities of cancellous bone, cortical bone and high concentration of osteoblasts, which induces additional bone growth at the recipient site. However, harvesting graft from the iliac crest may lead to morbidity in the donor site this agrees with *Marazik et al., 1980*, who reported that, many complications may occur after harvesting graft from the iliac crest including presence of prolonged postoperative pain, altered gait, sensory nerve damage, poor scar placement and altered bone contour.<sup>(8)</sup>

The mean length of stay in the hospital in all patients in this study was 1.5 days.

This agrees with *Dawson et al., 1996*, who reported that, the length of stay in the hospital after iliac crest bone harvesting varies widely from 6 to 2 days or even less. But this result disagree with *Freilich and Sandor, 2006*, who reported, taking iliac graft can be performed as an in-office surgery without an overnight stay.<sup>(9-10)</sup>

In this present study, no pain had been detected at the end of follow up period (i.e. after 6 months postoperative) according to the (VAS) score. This disagrees with *Goul et al., 1997*, who found that, 10% of patients experienced considerable pain for up to 6 months postoperatively. It is postulated that, this is either muscular or periosteal secondary to the stripping of abductors from the illum or neurogenic secondary to sensory nerve injury.<sup>(11)</sup>

At the end of this study, no patient had showed any gait disturbance. This agrees with *Massimo Fasolis et al., 2012*, who reported that the average duration of problems with walking was about 4 days. After 12 days postoperative, all patients can walk normally.<sup>(12)</sup> Also this result agrees with *Swan and Goodacre, 2006*, who reported that, minimal degree of soft tissue dissection is required to expose the cartilaginous cap of illum is responsible for the avoidance of occurrence of the so-called gluteal gait<sup>(13)</sup>.

In this study no numbness in the hip or the leg, from which the graft had been harvested, had been detected after 6 months postoperative. This disagrees with *Colterjohn and Bednar, 1997*, who reported that, the incidence of altered sensation of the lateral cutaneous nerve of the thigh ranged from 1.3-37%. Variations in the position of the nerve may be a contributing factor associated with injury of that nerve.<sup>(14)</sup>

In the present study, only one patient (case no. 8) showed presence of haematoma at the operation site after surgery that persisted for 1 month postoperatively but the haematoma had been disappeared with conservative treatment after 3 months postoperatively. The haematoma formation results from inadequate operative haemostasis, improper subperiosteal dissection, cancellous bone bleeding and no drains had been inserted into the site of the surgery. This results agree with *Tayapongsak et al., 1994*, who reported that, three patients (2.4%) developed haematoma at the operation site and they

reported that, haematoma formation can be reduced by use of sheets of absorbable haemostatic sponge and insertion of drain at the end of surgery.<sup>(15)</sup>

In this study only one patient (10%) case no (8) was not satisfied with healing of the wound and a noticeable scar was present at the operation site. This agrees with *Rawashdeh, 2008*, who reported that, the average scar satisfaction VAS score was 8.23, showing high patient satisfaction.<sup>(16)</sup>

The radiographical results of this study showed, occurrence of proper bone healing and no bony deformity had been detected at the hip donor site in all patients at the end of follow up periods. These results disagree with *Nocini et al., 2003*, who reported occurrence of fracture of the ilium in one patient 1 week after surgery, when entering an elevator.<sup>(17)</sup> But the result of this study agrees with *Wouter et al., 1996*, who reported that, contour defects occurs only in a small number of patients after split-thickness bone harvesting.<sup>(18)</sup>

No scar tenderness had been detected in all patients at the end of the follow up period (i.e. after six months from surgery). This result agrees with *Swan and Goodacre 2006*, who reported that, the procedure of harvesting graft from the iliac crest was considered to result in an aesthetically acceptable donor site scar without any tenderness.<sup>(13)</sup>

None of patients in this study developed postoperative deep infection (i.e. requiring surgical intervention) and this result agrees with *Kurz et al., 1989*, who reported that deep infection that required surgical intervention had occurred only in less than 1% of cases. However, the one patient in this study who developed superficial infection (case no. 8) had been treated properly by antibiotic therapy and the infection had been disappeared.<sup>(19)</sup>

## CONCLUSION

Bone harvesting from the inner table of the anterior iliac crest appears to be the golden solution when reconstructing defects as:

There is relatively low morbidity rate, There is adequate subjective accessibility and Patient can be discharged rapidly from the hospital.

So, the anterior iliac crest still remains the donor site of choice for reconstructive surgeries.

## REFERENCES

1. Banwart Jc, AsherMA and Hassanein RS. (1995): Iliac crest bone graft harvest donor site morbidity. Vol.20:1055-1060.
2. Ahlmann E, PatzakisM. and Roidis N. (2002): Comparison of anterior and posterior iliac crest bone grafts in term of harvest site morbidity and functional outcomes. J Bone Joint Surgery. Vol.(84):716-720.
3. Kessler P., Thorworth M, Bloch-Birkholz A. and Nkenke E. (2015): Harvesting of bone from the iliac crest comparison of the anterior and posterior sites. British Journal of Oral and Maxillofacial Surgery. Vol. 43:51-60.
4. Baquin ZH, Anabtwi M, Karaky AA and Mafkawi Z. (2009): Morbidity from anterior iliac crest bone harvesting for secondary alveolar bone grafting. An outcome assessment study. J oral Maxillofacial Surgery, vol.67:570-575.
5. Rudman R.A. (1997): Prospective evaluation of morbidity associated with iliac crest harvest for alveolar cleft grafting. J. Oral and Maxillofacial Surgery. Vol. 55-219.
6. Ahlmann E, Patzakiss M. and Roidis N. (2002): Comparison of anterior and posterior iliac crest bone grafts in term of harvest site morbidity and functional outcomes. J Bone Joint Surgery. Vol.84A:716-720.
7. Pollock R., Alcelik I., Bahatia C., Chuter G., Lingutla K., Budithi C., and Krishna M., (2008): Donor site morbidity following iliac crest bone harvesting for cervical fusion: a comparison between minimally invasive and open techniques. Eur. Spine Journal. Vol.17:845-852.
8. Marazik J, Amato C, letan S and Mashberg A. (1980): The ilium as source of autogenous bone for grafting. Clinical considerations. J. Oral Surgery 38:29-32.
9. Dawson K.H., Egbert M.A., and Myall R.W. (1996): Pain following iliac crest bone grafting of alveolar clefts. J. Craniomaxillofacial Surgery. 24:151-154.
10. Freilich MM and Sandor GK (2006): Ambulatory in-office anterior iliac crest bone harvesting. J. of oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology and Endodontics. 101:291-298.

11. Goulet JA, Senunas LE, Desilva GI and Greenfield ML.(1997): Autogenous iliac crest bone graft complications and functional assessment. *Clinical Orthopedic res*; 339:76-81.
12. Massimo Fasolis MD, Paolo Boffano MD and Guglielmo Ramieri MD (2012): Morbidity associated with anterior iliac crest bone graft. *J. Oral and Maxillofacial Surgery*. Vol. 144, no.5:586-591.
13. Swan MC and Goodacre TE (2006): Morbidity at the iliac crest donor site following bone grafting of the cleft alveolus. *Br. J. Oral Maxillofacial Surgery*.44:129-133.
14. Colterjohn NR and Bednar D.A. (1997): Procurement of bone graft from the iliac crest, an operative approach with decreased morbidity. *J. Bone Joint Surgery Am*. 79:756-759.
15. Tayapongsak P., Wilmsatt JA, Labance J.P. and Dolwick M. F. (1994): Morbidity from anterior ilium bone harvest. a comparative study of lateral versus medial surgical approach. *J. Oral Surgery, oral medicine, oral Pathology*, 78:296-300.
16. Rawashdeh MA. (2008): Morbidity of the iliac crest donor site following open bone harvesting in cleft lip and palate patients. *Int. J. Oralmaxillofacial Surgery*; 37:223-227.
17. Nocini PF, Bedogni A and Valsecchi (2003): Fractures of the iliac crest following anterior and posterior bone graft harvesting. Review of the literature and case presentation *Minerva Stomatol*.52:441.
18. Wouter W.I, Gerry M., Raghoobar M. D., Johan M, and Greet D.(1996): Morbidity from iliac crest bone harvesting. *J. oral Maxillofacial Surgery*. 54:1424-1429.
19. Kurz LT, Garfin SR, and Bouth R.E. (1989): Iliac bone grafting techniques and complications of harvesting. In Garfin SR (ed). *Complications of spine surgery*. Baltimore, Williams and Wilkins, pp323-341.