

Comparison of Morbidity and Complications of Harvesting Bone from the Iliac Crest and Calvarium: A Retrospective Study

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Abstract:

Background: The aim of this retrospective clinical study was to compare the complications after the harvest of bone from the iliac crest and the calvarium.

Materials and Methods: One hundred and eighty patients were selected for this study (125 iliac crest and 55 calvarium donor sites). Data were collected from the medical records and classified as major or minor complications for each procedure.

Results: The highest percentage of total complications (66.4%) was recorded when the iliac crest was harvested. The highest percentage of major complications was associated with the harvest of calvarium site (14.5%), while highest percentage of minor complications was associated with the harvest of the iliac site (60.8%).

Conclusion: Harvesting of the iliac crest was associated with the highest percentage of complications. Major complications were more observed with harvesting of the calvarium.

Key Words: Calvarium, complications, iliac crest, morbidity

Introduction

The use of dental implants is increasing in daily clinical practice due to their long-term success.^{1,2} Rehabilitation in edentulous regions may be complicated by crestal bone atrophy following tooth loss or extraction.^{3,4} Sinus pneumatization, together with poor bone quality, is one of the most challenging circumstances in implantology, a condition that will restrict implant placement in such areas.⁵

Diverse bone graft materials are used for maxillary sinus grafts that include intra- or extra-oral autologous bone, heterologous grafts, alloplastic grafts, xenografts, or a combination of these.^{6,7}

Boyne and James⁸ published the first report about maxillary sinus floor augmentation for placement of dental implants, while Tatum⁹ first described two techniques with a sinus approach from the alveolar crest and lateral wall in maxillary and sinus implant reconstruction.⁵

The popular use of autologous bone as sinus graft material is due to its osteoconductive, osteoinductive, and osteogenic properties.¹⁰ The autologous bone harvesting requires a donor site surgery that may increase patient's morbidity.¹¹⁻¹³ This procedure can be associated with a number of complications according to the harvested site; intraoral sites can involve damage to the mental and lower dental nerves, increasing the risk of the mandibular ramus fracture and involvement of tooth apices.¹⁴ Extraoral sites harvesting may cause hemorrhage, pain, instability of the sacroiliac joint and gait disturbances.¹⁵ These related complications pushed several authors to question the use of autologous bone in sinus grafting.^{10,16}

Clinical and histomorphometric studies performed on different type of allograft bone substitute reported that these materials are biocompatible, osseointegrative and showed success when used in combination with dental implants.¹⁷⁻¹⁹

The donor site complications/morbidity remains a major problem. The most frequent complication associated with iliac crest harvesting is pain; other complications include gait disturbance, infection, fracture of the iliac crest, hematoma, scars, and sensory disturbance.²⁰ Complications of the calvarium harvesting are pain, hospital readmission or extended stay, hair loss, itching, hematoma, and vertigo.²¹

The aim of this retrospective clinical study was to evaluate the morbidity following the harvest of bone from the iliac crest or calvarium used as bone grafts. The null hypothesis tested was that there was no difference in morbidity between the iliac crest and calvarium as a donor site.

Materials and Methods

Case selection

This study was conducted in coherence with the Helsinki agreement for research on humans, and the study design was approved by the Institutional Review Board and Independent Ethics Committee of the faculty of Dental Medicine, Saint-Joseph University, Beirut, Lebanon. Signed

informed consent forms were obtained for all participants in the study.

One hundred and eighty-six patients who had undergone reconstructive procedure using autologous bone grafts harvested from the iliac crest or the calvarium at the Department of Oral and Maxillofacial Surgery of the Faculty of Dental Medicine at Saint-Joseph University between September 2005 and October 2012 were included in this study. All patients had been treated by experienced specialist staff members or under the supervision of staff members.

Six patients were excluded from the study, as they did not attend all follow-up sessions. One hundred and eighty patients (118 female, 62 male, mean age 47 ± 7.2 years) were included in this retrospective study; all clinical parameters and data were collected from the medical records (Table 1).

Surgical methods

The selection of the donor site was based on the size/location of the defect and the patient/surgeon preference. The anterior iliac crest was used as a donor site for 100 and 25 patients; the bone harvested was carried out following the technique of Kalk *et al.*²² The calvarial bone (55 patients) was harvested using the Frodel technique²³ as a split bone from the outer table.

Clinical data obtained from the medical records were classified as major or minor donor site complications.

Data were analyzed using a statistical package for social sciences (SPSS 14, Chicago, IL, USA). Relation between clinical parameters and complications of morbidity at each donor site was calculated using the Pearson's Chi-squared (χ^2) test. The $P \leq 0.05$ were considered as significant.

Results

Major and minor complications per donor site are summarized in Table 2.

Complications were classified as short-term complications that include immediate up to 4 weeks post-operative morbidity at the donor site and long-term complications that involve the post-operative follow-up after 4 weeks up to 18 weeks.

Table 1: Clinical data of selected groups by donor site.

	Iliac crest	Calvarium
Number of patients (n)	125	55
Gender		
Male	30	32
Female	95	23
Age		
Mean	48	45
Indication		
Sinus floor augmentation	77	33
Mandibular ridge augmentation	33	20
Chin augmentation	15	2

The harvesting of the iliac crest as a donor site showed significantly highest percentage of total complications (66.4%) compared to the calvarium site (40%) ($P = 0.0016$). Highest percentage of major complications was associated with the harvest of calvarium site (14.5%) with no significant difference with the iliac crest harvested ($P = 0.087$), while the highest percentage of minor complications was associated with the harvest of the iliac site (60.8%) ($P < 0.0001$). Short-term complications were mostly observed with the iliac site harvesting (81.92%) that showed a significant difference with the calvarium group ($P = 0.0001$). Long-term complications were mostly reported in the calvarium site harvested group (45.5%) with no significant difference between the two study groups ($P = 0.383$).

Discussion

The data of the present study led to the rejection of the null hypothesis tested that there was no difference in morbidity between the iliac and calvarium harvested donor sites.

The ilium is considered as the gold standard for graft material, having a great reservoir of pluripotent or osteogenic precursor cells.²⁰ Large quantities of bone can be obtained from the ilium and the two surgery teams can work simultaneously.^{13,15} The complications/morbidity observed in this study after harvesting the ilium are similar to the findings reported by other authors.^{12,21,24,25} The required quantity of bone is the most important factor in decision-making of the technique used for bone harvest from the ilium. In the present study, the anterior approach to the ilium was preferred to the posterior one in order to decrease the post-operative morbidity/complications and the operation time.^{13,26,27} Pain was the most frequent minor post-operative complication (68%) observed with the harvest of the iliac crest, which is in accordance with other reports.^{13,21,28} Gait disturbance was considered as the second most frequent morbidity after the pain, both most probably related to the

Table 2: Iliac and calvarium donor sites complications.

	Iliac crest (%) n=125	Calvarium (%) n=55	P value
Major complications	7 (5.6)	8 (14.5)	0.08772
Hematoma	5	2	1
Infection	1	1	0.5189
Hemorrhage	1	3	0.0856
Fracture			
Alopecia		2	0.09218
Minor complications	76 (60.8)	14 (25.4)	<0.0001
Pain	52	7	0.00028
Edema	9	3	1
Vertigo		4	0.00806
Gait disturbance	15		0.00609
Short-term complications	68 (81.92)	12 (54.5)	0.0001
Long-term complications	15 (18.08)	10 (45.5)	0.3839
Total complications	83 (66.4)	22 (40)	0.00166

When cells have counts <5, Fisher exact test was used instead of Chi-square test. The $P \leq 0.05$ were considered as significant ($P < 0.05$).

muscular attachments to the ilium due to the reflection of the tensor fascia lata muscle.²⁹ For the same procedure, hematoma was the major complication reported that might be due to the harvesting technique and retraction of the muscle and ligaments.³⁰

Temporary sensory loss was not reported in this study, which is in conflict with previous studies.¹⁵ Fortunately, serious sensory disorders (neuralgia paresthesia) were not encountered.

The harvest of calvarial bone is a source of the large amount of bone with proximity to the receptor site that makes the operation more convenient when compared to the harvest from the ilium. The morbidity of this procedure can vary from minor to severe complications that sometime can be life-threatening.^{31,32} The major complications reported in this study with the calvarium bone harvest are alopecia, hemorrhage, and hematoma, which is in accordance with other reports.^{21,31,33} The esthetic concern might be the visible scar after hair loss leading to alopecia or itching of ingrown hairs.³²

The percentage of short-term complications was significantly higher when the iliac crest was harvested than the long-term complications, while no significant difference was noted between the two periods for the calvarium donor site. Our results are similar to other findings^{20,21} and in conflict with previous reports.¹¹ This might be due to the design of the study, documentation of the data, patients follow-up and decision-making. It can also be surgeon dependent, due to different level of skills for each surgeon or specialist.²¹

Future prospective clinical studies should be designed to validate the results of this study and more important to evaluate and compare the outcome of newly developed bone substitutes.

Conclusions

Within the limitations of this retrospective study, the following conclusions can be drawn:

1. The highest complication rate was observed when the iliac crest was used as a donor site mainly at short-term period
2. The highest major complication rate was observed when the calvarium was used as a donor site
3. Surgeons should be very cautious in selecting the donor site taking into consideration the different complication that can occur.

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