

Perioperative findings and complications of non-vascularised iliac crest graft harvest: The experience of a Nigerian tertiary hospital

Olusanya Adeola Adenike¹, Aladelusi Timothy Olukunle², Ifesanya Adeleke Olusegun³, Akinmoladun Victor Ifeolu¹, Arotiba Juwon Tunde¹

¹Consultant Oral and Maxillofacial Surgeon, ²Senior Registrar, Oral and Maxillofacial Surgery, ³Consultant Orthopaedic Surgeon, University College Hospital, Ibadan, Nigeria

ABSTRACT

Background: The reconstruction of a mandibular defect remains a significant challenge to the reconstructive surgeon. In developing countries like Nigeria, the required facilities and expertise for vascularised graft surgery are not readily available, thus mandibular defects are commonly reconstructed with non-vascularised bone grafts. The aim of this study is to describe the experience with the reconstruction of mandibular defects using non-vascularised iliac crest bone grafts (NVICBG) at a Nigerian tertiary hospital. **Patients and Methods:** This was a descriptive longitudinal study in which data was prospectively collected from patients who had mandibular reconstruction secondary to benign lesions using NVICBG at the University College Hospital, Ibadan, over a 24-month period. Information recorded included demography, cause of mandibular defect, type of mandibular resection, span of defect, peri-operative data, recipient site complications and donor site complications. Patient satisfaction with facial aesthetic outcome was assessed with the use of visual analogue scale score. **Results:** Twenty patients had mandibular resection and immediate reconstruction with NVICBG. The mean age was 31.61 (+/-11.05) years. Mean span of the defects was 10.65 (+/-2.88) cm. At the recipient site, two patients had extra-oral wound dehiscence and two patients had intra-oral wound dehiscence of which one patient had loss of the graft. Donor site complications noted were seromas and wound dehiscence. Eighteen patients had paraesthesia of the lateral femoral cutaneous nerve. All patients had temporary abnormal gait. The mean duration of abnormal gait was 2.11 weeks (SD +/-0.74). Majority of the patients were satisfied with the aesthetic outcome. **Conclusion:** NVICBG, though limited in its versatility has satisfactory aesthetic outcome with relatively few complications. It appears that this method of reconstruction can be used even for large mandibular defects contrary to perceptions of many reconstructive surgeons.

Key words: Complications, iliac crest graft, mandibular reconstruction

Address for correspondence:

Dr. Aladelusi TO,
Department of Oral and
Maxillofacial Surgery, University
College Hospital, Ibadan, Nigeria.
E-mail: drtimmylee@gmail.com

INTRODUCTION

The face is an important influential factor on an individual's self-esteem.^{1,2} The mandible is a major aesthetic landmark of the face; not only does it define an individual's outward form but it is also an integral component of facial harmony.³ The loss of a portion or whole of the mandible can therefore significantly impact

on an individual's self-esteem and therefore his/her psychosocial wellbeing.^{4,5}

The reconstruction of a mandibular defect is a major challenge to the reconstructive surgeon.⁴⁻⁷ The need for mandibular reconstruction is dictated by the loss of mandibular bone due to trauma, inflammatory disease, and benign or malignant tumours.⁸ There had been continuous evolution of options in quest of optimising reconstruction following mandibular resection. These options include prosthesis, Steinmann's pin, non-vascularised bone graft and microvascular tissue transfer. Microvascular tissue transfer is the state of the art in options for mandibular reconstruction, however, this technique is both facility and technique demanding.⁸ In developing countries like Nigeria, where there is dearth of the facilities and technique required for microvascular transfer, mandibular defects are

Access this article online	
Quick Response Code:	Website: www.nigeriamedj.com
	DOI: 10.4103/0300-1652.132046

more commonly reconstructed with non-vascularised bone grafts.^{9,10} This study aims to describe the experience of a Nigerian tertiary institution in the use of non-vascularised iliac crest bone graft (NVICBG) for mandibular defects.

PATIENTS AND METHODS

Data was collected from patients who had mandibular reconstruction (following resection of benign lesions) using NVICBG within a 2-year period (January 2009 to December 2010) in the Department of Oral and Maxillofacial Surgery, University College Hospital, Ibadan, Nigeria.

The iliac crest harvest was done using the technique described by Ogunlade *et al.*,⁹ In lateral mandibular defects, the iliac crest grafts were harvested as a single block of non-vascularised bone from the contra-lateral ilium to obtain a favourable curvature. However, when the lesion involved the central part of the mandible, iliac crest graft was harvested from either side. The harvested graft was contoured using multiple osteotomies as dictated by the mandibular defect [Figure 1]. The graft was subsequently secured to the recipient site using 0.5 mm soft stainless steel trans-osseous wires after the residual mandibular segment(s) has been stabilised using intermaxillary fixation. Post-operatively, patient was placed on prophylactic antibiotics (intravenous ceftriaxone and metronidazole) and analgesics (intravenous pentazocine for 48-72 hours) and subsequently on oral paracetamol and diclofenac.

Information collected included the biodata of the patients, the aetiology of the mandibular defects, the extent of mandibular resection, the span of the defect, the peri-operative data, recipient site complications (infection, wound dehiscence and loss of graft), donor site complications (infection, wound dehiscence, seroma/haematoma formation, paralytic ileus, lateral cutaneous nerve functional impairment, abdominal hernia, cosmetic contour deformity, persistent pain and gait disturbances)¹¹ and duration of abnormal gait. Facial aesthetic outcome was reported by the patient using a visual analogue scale of 0-10 with 0 being the worst possible outcome and 10 being the best possible outcome.

The age of the patient, span of defect and duration of gait abnormality were descriptively analysed while the frequencies of other variables were described.

RESULTS

A total of 20 patients who had mandibular defects subsequent to benign tumour excision underwent immediate iliac crest graft reconstruction during the study period. There were 8 males and 12 females (M:F = 1:1.5). The mean age was 31.61 (+/-11.05) years. All the defects were secondary to benign tumour resection.

The range and mean pre-operative packed cell volume, estimated blood loss, immediate post-operative packed cell volume and the pattern of blood transfusion are as shown in Table 1. The mean estimated blood loss was 964.5 ml (+/-581.56). Majority of the patients required no blood transfusion (60%), while 20% were transfused with one unit of whole blood and another 20% required transfusion with 2 units of whole blood.

Eleven patients had segmental defects while nine (45%) patients had hemimandibular continuity defect (mandibular resection with disarticulation of the mandibular condyle on one side). The range of reconstructed mandibular defect was 4.8-15.5 cm with a mean span of 10.65 (+/-2.88) cm [Table 1].

Considering pain at the donor site, majority of the patients (65%) reported moderate post-operative pain in the first 48 h of surgery, 30% reported mild pain while 1 patient (5%) reported severe pain. However, by the end of post-operative day 8, 85% of the patient reported mild pain while only 10% still complained of moderate pain from the operative site. By the 6th week post-operatively, 95% of the patient reported no pain from the operation site while one (5%) patient still complained of mild pain from the donor site [Table 2].

Majority of the patients had no complication at the recipient site while all the patients had gait abnormality in the immediate post-operative period. Majority of the patients (80%) had uneventful recipient site healing, the most common donor site complication was gait abnormality, which was present in all patients at the immediate post-operative period, at 6 weeks post-operatively only 30% of the patient still had gait abnormality [Table 3]. Considering gait abnormality, 25% of the patients returned to normal gait in 3 weeks while 70% had returned to normal gait by the sixth week following the surgery. The mean duration of abnormal gait was 2.11 weeks (+/-0.737). Majority of the patients were satisfied with the aesthetic outcome of their mandibular reconstruction [Figure 2 and Table 4].

Table 1: Peri-operative parameters

Parameter	Minimum	Maximum	Mean
Age (years)	15	55	31.6
Span (cm)			
Overall	4.8	15.5	10.7 (+/-2.88)
Segmental defect	4.8	11.6	8.6 (+/-1.24)
Disarticulation defect	11.6	15.5	13.1 (+/-2.14)
Pre-operative PCV (%)	27	46	37.30 (+/-4.47)
Estimated blood loss (mL)	400	2,670	964.5 (+/-581.56)
Immediate post-operative PCV (%)	26	43	31.45 (+/-4.92)
Blood transfusion (units)	1	2	1.5 (+/-0.54)

Table 2: Post-operative discomfort

	48 h post-operative (%)	1 week post-operative (%)	3 weeks post-operative (%)	6 weeks post-operative (%)
Pain				
None	—	1 (5.0)	14 (70.0)	19 (95.0)
Mild	6 (30.0)	17 (85.0)	5 (25.0)	1 (5.0)
Moderate	13 (65.0)	2 (10.0)	—	—
Severe	1 (5.0)	—	—	—
Movement				
Cannot sit up in bed	6 (30.0)	1 (5.0)	—	—
Can sit up but cannot get out of bed	11 (55.0)	—	—	—
Can get out of bed but cannot walk without support	3 (15.0)	8 (40.0)	1 (5.0)	—
Can walk without support but limps	—	11 (55.0)	14 (70.0)	5 (25.0)
Can walk as before	—	—	5 (25.0)	15 (75.0)

DISCUSSION

Surgeons have been attempting to reconstruct mandibular defects for more than a century.^{8,12} Despite significant advances in reconstructive options achieved particularly over the past 40 years, the ideal solution — implying an anatomical reconstruction with sufficient height of the mandible and adequate muscle attachments to allow for normal function — is yet to be achieved.^{7,8,13-16} In our environment, non-vascularised bone has continued to provide an affordable and less technically demanding option for mandibular reconstruction.^{17,18}

The ‘Andy Gump’ deformity, which results from anterior mandibular arch resection without reconstruction, results in striking functional and aesthetic morbidity. These patients have major problems with oral competence, eating, speaking and swallowing.¹⁹ The curved shape of the symphysis tends to be more difficult to re-create compared with the relative straight segments of the posterior and lateral regions of the mandible. The shape of the mandible also influence the appearance of the lip, vertical height and projection of the lower face.²⁰ Reconstruction of a mandibular central defect is particularly challenging due to the fact that the symphysis has multiple forces acting across the region depending on the mandibular function.²⁰ Both compressive and tensile forces are present as well as torsional forces placing significant stress on any construct.²¹ The symphysis also serves as the site for attachment of the suprahyoid and tongue musculature.

In the present study, all mandibular reconstructions were done as primary procedures and were carried out using non-vascularised iliac crest graft secured with stainless steel wires. This is because the facilities and the skill for microvascular transfer required for vascularised bone graft are not readily available at our centre as at the time of this study. Reconstruction of the mandible tends to be less satisfactory in anterior defects, that is, the more anterior the defect, the less satisfactory the outcome. Clinically, the neo-mandible in the anterior region progressively showed

Table 3: Pattern of complications observed in this study

Parameter (Number of patients)	Values (%)
Recipient site complications	
No complications (16)	80.0
Infection and intra-oral wound dehiscence (1)	5.0
Infection, intra-oral wound dehiscence and loss of graft (1)	5.0
Extra-oral wound dehiscence (2)	10.0
Donor site complications	
Altered gait in immediate post-operative period (20)	100.0
LFCN anaesthesia (18)	90.0
Seroma formation (3)	15.0
Wound dehiscence (1)	5.0
Seroma and wound dehiscence (1)	5.0
Resolution of altered gait	
Less than 3 weeks (5)	25.0
Greater than 3 weeks but less than 6 weeks (9)	45.0
Greater than 6 weeks but less than 12 weeks (6)	30.0
Resolution of LFCN paraesthesia	
Greater than 3 weeks but less than 6 weeks (5)	27.8
Greater than 6 weeks but less than 12 weeks (13)	72.2

Table 4: Patient perceived outcome of mandibular reconstruction

	Grade			Total
	Not satisfied (0-3)	Fairly satisfied (4-6)	Moderately satisfied (7-8)	
Anterior	1	1	3	5
Posterior	0	2	6	8
Anterior/posterior	0	5	2	7
Total	1	8	11	20

varying degrees of deviation, which is attributable to the non-rigid fixation technique that was employed. Placement of a rigid fixation could ameliorate this deviation and further help in maintaining the achieved contour.²² However, rigid fixation devices were unaffordable by majority of our patients. The lateral and posterior defects did not require much contouring and the outcome appeared to be more

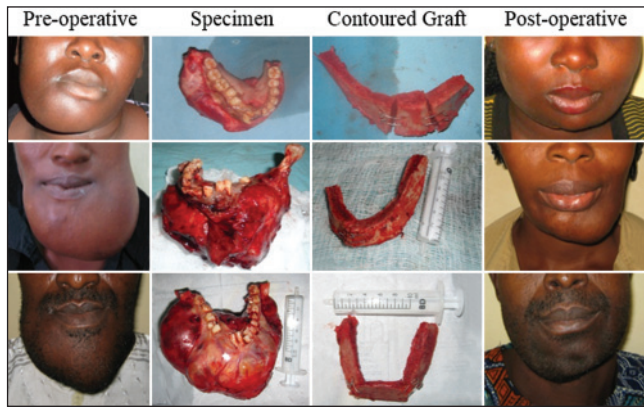


Figure 1: Pictures of some of the cases in this study

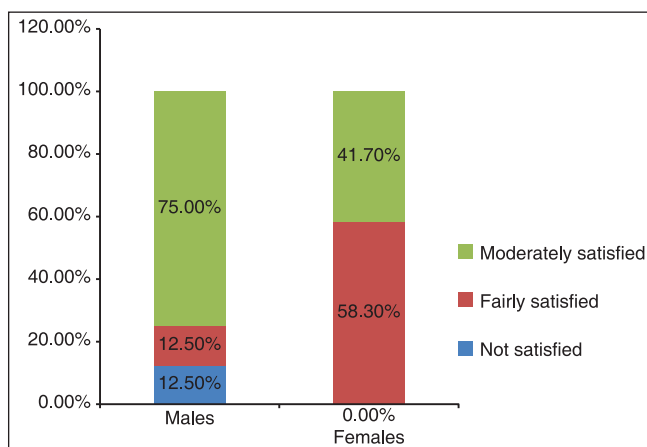


Figure 2: Gender and satisfaction with outcome

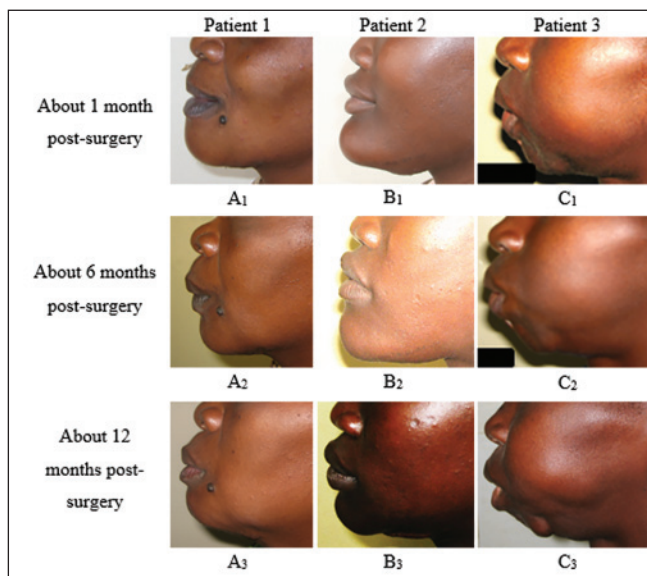


Figure 3: Gradual resorption of the reconstructed mandible

acceptable to the patient [Table 4]. Patients perceive their outcomes differently from surgeons or other observers,

and also, patient perception may differ by gender.³ Female patients had a more negative view of the aesthetic results than men as less than half of the female patients were fairly satisfied with the outcome while majority of the male patients were moderately satisfied with the outcome of reconstruction [Figure 3]. This is similar to the findings of Holzle *et al.*,²³ who examined 113 patients who underwent mandibular reconstruction using predominantly fibular osteocutaneous free flaps, they reported that 62% of female and 34% of male patients judged their post-operative aesthetic outcome as 'poor'. Holzle *et al.*,²³ also noted that despite the fact that female patients had a more negative view of their aesthetic results than men, female patients expressed greater satisfaction than men regarding their functional outcome.

Persistent pain at the donor site is a major deficit for the patient as this may result in functional limitation (e.g. limitations in employment, recreation, household chores, sexual activity and walking difficulty).²⁴ The exact cause of donor site pain remains unclear. It is postulated that this is either muscular or periosteal, secondary to the stripping of abductors from the ilium or neurogenic secondary to sensory nerve injury.¹¹ In order to overcome the problem of pain at the donor site, several technical modifications have been suggested²⁵⁻²⁹ also the use of post-operative regional anaesthesia³⁰ is encouraged. In the present study, majority of the patients (95%) reported mild-to-moderate post-operative pain from the donor site. In all but one patient (who reported mild pain), pain was fully resolved by 6 weeks post-operatively. This is similar to the findings of Nkenke *et al.*,³¹ and Kessler *et al.*,³² who reported continued reduction in perceived pain over a period of 28-30 days with no patient reporting long lasting pain. Also, Joshi and Kostakis¹¹ reported that 70% of their patients were pain free at 4 weeks post-operatively with only 10% of the patients experiencing pain for more than 16 weeks. This, however, differs from the report of Kim *et al.*,²⁴ who stated that despite the reduction in pain over a 1-year period following the surgery, 16.5% of patients who had elective spine surgery in association with the iliac crest harvest complained of pain from the donor site at 12 months post-operatively.

Gait disturbance after bone harvesting from the inner table is a minimal and temporary inconvenience.^{11,33,34} In the present study, we observed that about half of the patients had gait disturbance as at the end of the first post-operative week; however, three-quarters of the patients were able to walk normally after 6 weeks of surgery despite the fact that the span of the defect reconstructed was 4.8-15.5 cm. This is similar to the finding of Joshi and Kostakis¹¹ who reported that 86.7% of their patients were able to walk without any difficulties 6 weeks post-operatively. Fasolis *et al.*,³⁵ also reported that the average duration of walking abnormality, such as gluteal gait, was 4.24 days (range 1-12; SD 1.88;

median 4). Kessler *et al.*,³² in a comparison of morbidity observed in harvesting iliac crest graft from anterior and posterior sites noted that 2 weeks after surgery, irregularities of gait was seen in 26 (32%) of the 81 patients after harvesting bone from the anterior iliac crest, but in only 3 patients (6%) after the posterior approach. After 4 weeks, eight patients who had the anterior operation still had problems in walking, whereas in the posterior crest harvest only one patient still had problems with walking. Despite lesser morbidity associated with posterior harvest, the patient has to be repositioned intra-operatively³¹ and the technique does not allow for simultaneous tumour ablation and graft harvest. Other authors³⁶ also reported that there were no obvious differences between the two approaches for iliac bone harvesting. However, there is a consensus that the posterior approach is preferred for larger graft amounts.^{32,35,36}

Also noticed is the gradual resorption of the reconstructed mandible, which was more obvious with the anterior reconstructions as illustrated in Figure 3. It is estimated from our observations that by a year post-mandibular reconstruction using non-vascularised bone graft, about one-third to half the volume of the bone graft would have resorbed. This, however, is based on clinical observation and the precise rate of resorption and factors dictating or affecting the manner of resorption requires further investigation.

The mean estimated blood loss in the patients was less than 1 L and blood transfusion was necessitated in 40% of the patients with 20% receiving one unit of whole blood while another 20% received two units of whole blood.

This series represents the first known to the authors to prospectively document the peri-operative parameters as well as itemise complications of mandibular reconstruction with immediate iliac crest graft reconstruction in our environment.^{10,17,37}

CONCLUSION

NVICBG, though limited in its attributes, appears to have served considerably well with few complications. This method of reconstruction can be used even for large defects contrary to common beliefs among reconstructive surgeons. Majority of our patients also found the aesthetic outcome fairly acceptable.

REFERENCES

- Larrabee Jr WF, Makielski KH, Henderson JL. Surgical anatomy of the face. 2nd ed. Philadelphia: Lippincott Williams & Wilkins; 2004. p. 3-4.
- Ukpong DI, Ugboko VI, Ndukwe KC, Gbolahan O. Psychological complications of maxillofacial trauma: preliminary findings from a Nigerian university teaching hospital. *J Oral Maxillofac Surg* 2007;65:891-894.
- Heffelfinger RN, Malhotra PS, Fishman MA. Aesthetic considerations in mandibular reconstruction. *Facial Plast Surg* 2008;24:35-42.
- Chim H, Salgado CJ, Mardini S, Chen HC. Reconstruction of mandibular defects. *Semin Plast Surg* 2010;24:188-197.
- Hailer JR, Sullivan MJ. Contemporary techniques of mandibular reconstruction. *Am J Otolaryngol* 1995;16:19-23.
- Chopra S, Enepekides DJ. The role of distraction osteogenesis in mandibular reconstruction. *Curr Opin Otolaryngol Head Neck Surg* 2007;15:197-201.
- Miles BA, Goldstein DP, Gilbert RW, Gullane PJ. Mandible reconstruction. *Curr Opin Otolaryngol Head Neck Surg* 2010;18:317-322.
- Goh BT, Lee S, Tiderman H, Stoelinga PJ. Mandibular reconstruction in adults: A review. *Int J Oral Maxillofac Surg* 2008;37:597-605.
- Ogunlade SO, Arotiba JT, Fasola OA. Autogenous corticocancellous iliac bone graft in reconstruction of mandibular defect: Point of technique. *Afr J Biomed Res* 2010;13:157-160.
- Arotiba JT, Obimakinde OS, Ogunlade SO, Fasola AO, Ojoje VN, Akinmoladun VI, *et al.* An audit of mandibular defect reconstruction methods in a Nigerian Tertiary Hospital. *Niger Postgrad Med J* 2011;18:172-176.
- Joshi A, Kostakis GC. An investigation of post-operative morbidity following iliac crest graft harvesting. *Br Dent J* 2004;196:167-171.
- Lin PY, Lin KC, Jeng SF. Oromandibular reconstruction: The history, operative options and strategies, and our experience. *ISRN Surg* 2011;2011:824251.
- Bak M, Jacobson AS, Buchbinder D, Urken ML. Contemporary reconstruction of the mandible. *Oral Oncol* 2010;46:71-76.
- Hayden RE, Mullin DP, Patel AK. Reconstruction of the segmental mandibular defect : Current state of the art. *Curr Opin Otolaryngol Head Neck Surg* 2012;20:231-236.
- Stošić S. Mandibular reconstruction--state of the art and perspectives. *Vojnosanit Pregl* 2008;65:397-403.
- Torrioni A. Engineered bone grafts and bone flaps for maxillofacial defects: State of the art. *J Oral Maxillofac Surg* 2009;67:1121-1127.
- Ojoje VN, Obimakinde OS, Arotiba JT, Fasola AO, Ogunlade SO, Obiechina AE. Mandibular defect reconstruction with nonvascularized iliac crest bone graft. *Niger J Clin Pract* 2012;15:224-227.
- Akinmoladun VI, Olusanya AA, Olawole WO. Condylar disarticulation; Analysis of 20 cases from a nigerian tertiary centre. *Niger J Surg* 2012;18:68-70.
- Farwell DG, Futran ND. Oromandibular reconstruction. *Facial Plast Surg* 2000;16:115-126.
- Potter JK. Mandibular Reconstruction. In: Bagheri SC, Bell RB, Khan HA, editors. *Current Therapy in Oral and Maxillofacial Surgery*. Missouri: Saunders Elsevier Inc; 2012. p. 483-496.
- Wong RC, Tideman H, Kin L, Merckx MA. Biomechanics of mandibular reconstruction: A review. *Int J Oral Maxillofac Surg* 2010;39:313-319.
- Kim Y, Smith J, Sercarz JA, Head C, Abemayor E, Blackwell KE. Fixation of mandibular osteotomies: Comparison of locking and nonlocking hardware. *Head Neck* 2007;29:453-457.
- Holzle F, Kesting MR, Holzle G, Watola A, Loeffelbein DJ, Ervens J, *et al.* Clinical outcome and patient satisfaction after mandibular reconstruction with free fibula flaps. *Int J Oral Maxillofac Surg* 2007;36:802-806.
- Kim DH, Rhim R, Li L, Martha J, Swaim BH, Banco RJ, *et al.* Prospective study of iliac crest bone graft harvest site pain and morbidity. *Spine J* 2009;9:886-892.
- Colterjohn NR, Bednar DA. Procurement of bone graft from the iliac crest. An approach with decreased morbidity. *J Bone Joint Surg Am* 1997;79:756-759.
- Burstein FD, Simms C, Cohen SR, Work F, Paschal M. Iliac crest bone graft harvesting techniques: A comparison. *Plast Reconstr Surg* 2000;105:34-39.

27. Tanishima T, Yoshimasu N, Ogai M. A technique for prevention of donor site pain associated with harvesting iliac bone grafts. *Surg Neurol* 1995;44:131-132.
28. Martinez V, Ben Ammar S, Judet T, Bouhassira D, Chauvin M, Fletcher D. Risk factors predictive of chronic postsurgical neuropathic pain : The value of the iliac crest bone harvest model. *Pain* 2012;153:1478-1483.
29. Zouhary KJ. Bone graft harvesting from distant sites: Concepts and techniques. *Oral Maxillofac Surg Clin North Am* 2010;22:301-316.
30. Wilson PA. Pain relief following iliac crest bone harvesting. *Br J Oral Maxillofac Surg* 1995;33:242-243.
31. Nkenke E, Weisbach V, Winckler E, Kessler P, Schultze-Mosgau S, Wiltfang J, *et al.* Morbidity of harvesting of bone grafts from the iliac crest for preprosthetic augmentation procedures: A prospective study. *Int J Oral Maxillofac Surg* 2004;33:157-63.
32. Kessler P, Thorwarth M, Bloch-Birkholz A, Nkenke E, Neukam FW. Harvesting of bone from the iliac crest--comparison of the anterior and posterior sites. *Br J Oral Maxillofac Surg* 2005;43:51-56.
33. Kalk WW, Raghoobar GM, Jansma J, Boering G. Morbidity from iliac crest bone harvest. *J Oral Maxillofac Surg* 1996;54:1424-1429.
34. Ahlmann E, Patzakis M, Roidis N, Shepherd L, Holtom P. Comparison of anterior and posterior iliac crest bone grafts in terms of harvest-site morbidity and functional outcomes. *J Bone Joint Surg Am* 2002;48:716-720.
35. Fasolis M, Boffano P, Ramieri G. Morbidity associated with anterior iliac crest bone graft. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2012;114:586-591.
36. Becker ST, Warnke PH, Behrens E, Wiltfang J. Morbidity after iliac crest bone graft harvesting over an anterior versus posterior approach. *J Oral Maxillofac Surg* 2011;69:48-53.
37. Obiechina AE, Ogunlade SO, Fasola AO, Arotiba JT. Mandibular segmental reconstruction with iliac crest. *West Afr J Med* 2003;22:46-49.

How to cite this article: Adenike OA, Olukunle AT, Olusegun IA, Ifeolu AV, Tunde AJ. Perioperative findings and complications of non-vascularised iliac crest graft harvest: The experience of a Nigerian tertiary hospital. *Niger Med J* 2014;55:224-9.

Source of Support: Nil, **Conflict of Interest:** None declared.