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ORIGINAL ARTICLE

Mandibular defect reconstruction with nonvascularized iliac crest bone graft

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Abstract

Context: Reconstruction of mandibular defect is a challenge to the head and neck surgeon because of associated functional and esthetic problems. Our experience with the use of nonvascularized iliac crest bone graft is hereby reported.
Aim: The aim was to report our experience with the use of nonvascularized iliac crest bone for mandibular defect reconstruction at University College Hospital, Ibadan. Nigeria.
Settings and Design: A retrospective descriptive study was performed.
Materials and Methods: Cases of mandibular reconstruction with iliac crest bone graft between January 2001 and December 2007 were included in this study. Grafts were secured with either a stainless steel wire or a titanium plate. Preoperative diagnosis, postoperative follow-up records including investigations, diagnosis of graft infection and subsequent treatment modalities were extracted from the available records.
Statistical analysis used: Descriptive variables were analyzed with SPSS version 14.
Results: A total of 47 patients had mandibular defect reconstruction with nonvascularized iliac crest block bone during the study period. Thirty-eight patients had graft secured with transosseous wire [NVIBw] while 9 had a titanium plate [NVIBp]. The male:female ratio was 26:21 while the mean age of the patients was 24.6±4.25 years. Ten patients (21.3%) developed persistent graft infection during the postoperative period. All cases of infection occurred in patients who had transosseous wiring and analysis showed that 60% of the infected grafts revealed mixed microbial isolates containing *klebsiela spp*, *pseudomonas aeurogenosa*, and *e coli*. Six (60%) of the infected grafts were removed as a result of unabated infection while 4 (40%) were successfully treated by exploration and pus drainage.
Conclusions: Nonvascularized iliac crest bone graft provides an affordable and less technical choice for mandibular reconstruction with minimal complications in a resource-limited economy.

Key words: Iliac crest bone graft, infection, mandibular defect

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Introduction

Mandible is a horse-shoe-shaped bone that forms the skeletal frame of the lower third of the face.[1] It receives attachments of muscles of mastication and plays an important role in speech, mastication, and esthetics.[1-3] It is therefore necessary to reconstruct mandibular continuity defect in order to restore appearance and function.

Mandibular reconstruction has met with significant advances in recent time and various options that have been mentioned in the literature include autogenic graft (vascularized and nonvascularized), allelograft and xenograft.[2,4-6] Recently distraction osteogenesis and genetically engineered bone have been advocated[1,7-10] but

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the high cost of these newer modalities of treatment and lack of appropriate facilities remain a major limitation to their use in developing countries. Microvascular composite flaps have been reported to have satisfactory outcome in the literature and it is recommended for use where appropriate facilities are available.[11-14] However, due to the long duration of surgery and morbidities resulting from this technique, it has been recommended for use in mandibular defects resulting from excision of malignant tumors or previously irradiated site.[4,13] Flap failure and tumor recurrence are other complications associated with this technique.[1] The use of bridging titanium plates is another viable option for mandibular reconstruction following ablative surgery especially when microvascular reconstruction is not feasible.[3,6] Satisfactory outcomes have been reported with the use of bridging mandibular plates but hardware rejection and fracture remain its major disadvantage.[1,3]

Nonvascularized bone provides a useful alternative for reconstruction of mandibular defects resulting from surgical excision of benign destructive lesions and trauma.[2,15,16] It is recommended for use in a resource-limited economy where newer modalities are not being practiced due to high cost and limited expertise.[2] Donor sites such as the ilium, rib, scapula, clavicle and fibula have been described.[1,2,14] Most authors however prefer the iliac crest bone for mandibular reconstruction because it provides adequate osseous bulk and contour.[2,10,14-16] A study of the biomechanic properties of the iliac crest showed that the stress distribution on iliac crest graft is akin to that of the mandible.[16]

Although the literature is replete with foreign reports on the suitability of iliac crest bone for mandibular reconstruction,[1,3-6,11,14,15] there is dearth of studies on this subject from Nigerian literature. The aim of this study was to report our experience with the use of nonvascularized iliac crest bone graft for mandibular reconstruction at the University College Hospital, Ibadan, Nigeria.

Materials and Methods

The study comprised patients who had mandibular reconstruction with nonvascularized iliac bone (NVIB) between January 2001 and December 2007. The patients had surgical excision of mandibular tumors and segmental defects due to trauma. Patients who were treated for benign mandibular lesion but had reconstruction without NVIB were excluded from the study.

Demographic records, preoperative diagnosis, postoperative records of graft survival (including radiographs) and complications were retrieved from patients' case notes and operation register.

All patients had mandibular reconstruction under general anesthesia with nonvascularized bone from the contralateral iliac crest which was anchored to the remnant of the mandible by either transosseous wiring using 0.5 mm soft stainless steel wire or 2--2.4 mm titanium locking plates with screws. All patients had immediate reconstruction of the mandible and the graft harvest was done by the orthopaedic surgeon.

Mandibular defects were classified as central, lateral, combined central and lateral defects and free end defects.

Successful reconstruction was defined as the absence of wound breakdown, freedom from infection, bony continuity and stability, long term maintenance of osseous bulk.[5] In patients with graft infection, microbial isolates of such infections and the sequelae were also recorded. Patients' postoperative records were followed up for a 1-year period.

The data obtained were represented on frequency table and descriptive variables analyzed with SPSS version 14.

Results

A total of 47 patients had mandibular reconstruction with nonvascularized iliac crest block bone graft during the study period. Ameloblastoma [n=36] accounted for 76.6% of the lesions necessitating mandibular reconstruction. Table 1 shows a breakdown of the mandibular lesions in our series.

There were 26 males and 21 females [m:f=1:0.8]. The average age of the patients was 24.6±4.3 years while the age range is 12-45 years.

Lateral defect of the mandible accounted for more than 40% of all the defects reconstructed with NVIB [Table 1]. Central defects were the least common among the patients treated.

Appearance was adjudged satisfactory by the patients in 42 cases (89.4%). Graft infection occurred in 10 (21.3%) patients during the postoperative period [Table 2]. Intraoral wound dehiscence was reported in 4 of our patients while orocutaneous fistula occurred in 1 case. Figure 1 showed the complications of mandibular reconstruction with nonvascularized iliac bone in our series.

Of the 10 cases with infected NVIB, 6 (60%) showed mixed microbial isolates comprising *Klebsiela spp*, *Pseudomonas aeurogenosa* and *E coli* predominantly. Single isolates were recorded only in 4 cases [Table 2]. In all, 7 (70%) of the infected cases followed resection of ameloblastoma. Fifty percent of the infected cases were lateral defects while only two cases of free end defects were infected. Six (60%) of the infected grafts were excised due to unabated infection while the remaining four were treated with parenteral antibiotics, wound exploration and drainage of pus.

Table 1: Location of mandibular continuity defect

	Central frequency (%)	Lateral frequency (%)	Central and Lateral frequency (%)	Free end lateral frequency (%)
Ameloblastoma[36]	5 (10.7)	15 (32.1)	9 (19.2)	7 (14.9)
Primodial cysts[1]	-	-	-	1 (2.1)
Dentigerous cysts[2]	-	1 (2.1)	1 (2.1)	-
Gun shot[1]	-	1 (2.1)	-	-
Mandibular fracture[1]	-	1 (2.1)	-	-
Ossifying fibroma[2]	1 (2.1)	1 (2.1)	-	-
Fibromyxoma[1]	-	1 (2.1)	-	-
Ameloblastic carcinoma[2]	-	1 (2.1)	1 (2.1)	-
Osteosarcoma[1]	-	-	1 (2.1)	-
Total	6 (12.8)	21 (44.7)	12 (25.5)	8 (17)

Table 2: Microbial isolates and treatments given to patients with graft infection

Diagnosis	Age/sex	Defect	Isolate	Medication	Outcome
Ameloblastoma	17/m	Posterior	*E. coli, Klebsiela, Pseudomonas*	Ceftriaxone	Satisfactory
Ameloblastoma	36/m	Lateral	*E coli, Pseudomonas*	Sparfloxacine	Graft excision
Ameloblastoma	45/m	Central+lateral	*Staph aureus*	Ceftriaxone	Graft excision
Dentigerous cyst	20/m	Central+lateral	*Strept Pyogenes*	Ceftriaxone	Graft excision
Gun shot	36/m	Lateral	*Klebsiela pneumonea*	Amoxycilline +clavulanic acid	Graft excision
Ameloblastoma	17/f	Lateral	*E coli, Klebsiela, Pseudomonas*	Cefuroxime	Satisfactory
Primodial cyst	25/m	Posterior	*Klebsiela pneumonia*	Amoxicillin +clavulanic acid	Graft excision
Ameloblastoma	39/m	Lateral	*E. coli, Pseudomonas*	Cefuroxime	Satisfactory
Ameloblastoma	32/f	Central+lateral	*Staph aureus*	Ciprofloxacine	Graft excision
Ameloblastoma	22/f	Lateral	*Pseudomonas*	Cefuroxime	Satisfactory

Donor site complications included three cases of infection, two cases of paresthesia of the lateral femoral cutaneous nerve which resolved within 2 months of follow-up visits. Two patients had initial gait disturbance which resolved later while three cases of wound dehiscence at the donor site were recorded [Figure 1].

Discussion

The treatment of mandibular tumors often requires the resection of a segment of the bone with subsequent substantial continuity defect.[1] Aesthetic, speech, and mastication are adversely affected in such situations and the patient's quality of life deteriorates significantly.[17] It is therefore imperative to reconstruct the mandible following excision of tumors which involve resection of mandibular segment.[2,3]

The aim of mandibular reconstruction is to primarily restore continuity and bony contour.[1-4,18] In this study bony continuity and esthetic was adjudged to be satisfactory by 89.4% of the patients. This is similar to findings of some authors where the range of successful reconstruction was reported as 38--100%.[2,5,6] They opined that satisfactory outcome is more likely in reconstructing defects arising from treatment of benign jaw lesions and trauma with NVIB[2,5]

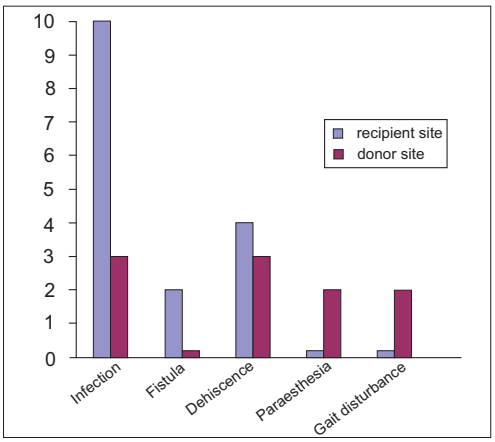

Figure 1: The figure showed that 10 patients had postoperative wound infection at the recipient site while three cases occurred at the donor site, wound dehiscence at the donor, and recipient sites had a frequency of 3 and 4 respectively, one patient had oro-cutaneous fistula at the recipient site. There were two cases each of paresthesia of lateral femoral cutaneous nerve of the thigh and initial gait disturbance

The incidence of graft infection of 21.3% is comparable to the findings of Meredith *et al*[5] who reported 29% cases of infection in their analysis of 70 mandibular continuity defects out of which 68 cases were reconstructed with NVIB. Infection was the only complication necessitating graft removal in our study. In addition, other studies reported tumor recurrence as indication for graft removal mostly in patients treated for malignant lesions.[14,19] Tumor

recurrence and complications of radiotherapy were not in our finding probably because we rarely reconstruct defects arising from surgery of malignant disease with NVIB in our center. Factors such as duration of surgery, interval between graft harvest and placement, time surgical drain being left *in situ* have contributed to the incidence of graft infection.[5,14,18-20] All patients in this study were placed on a course of postoperative antibiotic regime for 1 week and their surgical drains were removed 48 hours postoperative. Egyedi *et al*[20] advocated a full 10-day course of intravenous antibiotics to prevent graft infection while the use of allelografts was advocated by some authors because they are less prone to infection and easy to place. Some authors reported that intraoral wound dehiscence, orocutaneous fistula, graft nonunion, graft rotation or malposition have been found to be contributory to graft failure.[5,18-20] In our study, three of the four cases of wound dehiscence had graft removal because of unabated infection.

The microbial isolate pattern recorded in this study showed dominance of mixed isolates in most of the cultures. The presence of *E coli, Klebsiela spp*, and *Pseudomonas aeuroginosa* may explain the influence of hospital acquired infection in our patients because these organisms are rarely regarded as components of the oral microfloral.

Conclusion

It can be concluded from this study that nonvascularized bone provides an affordable and less technical choice for mandibular reconstruction in developing economies with little complications. We therefore recommend its use for reconstruction of mandibular defects resulting from excision of benign odontogenic tumors and trauma.

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