Sinus Floor Elevation and Implant Placement via the Crestal and Lateral Approach in Patients With Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome: Report of Two Cases

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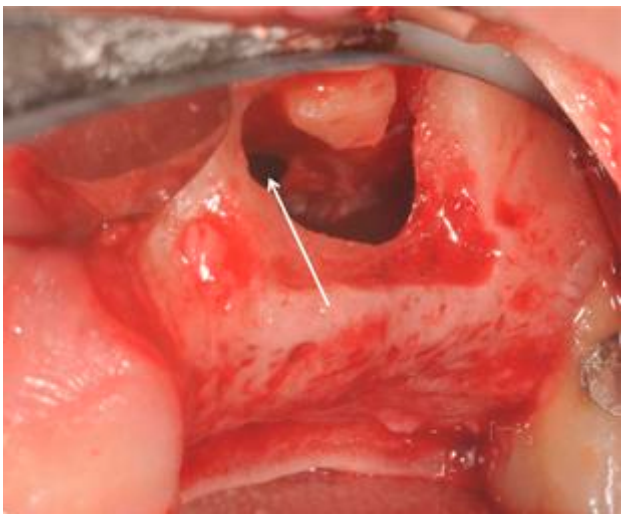

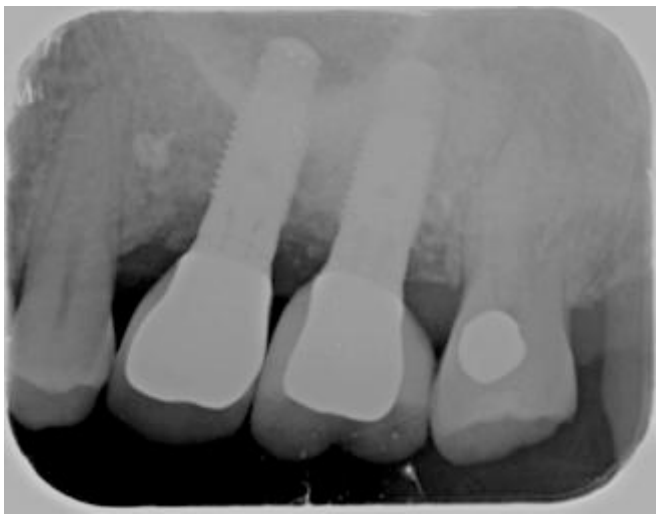

Introduction: Implant placement in the posterior maxilla is frequently complicated by sinus proximity. Intraoral surgical procedures, including implant placement, have been described in patients with human immunodeficiency virus (HIV)/acquired immune deficiency syndrome (AIDS). Although reported widely in the general population, there is no description of implant placement with sinus floor augmentation (SFA) in these individuals. To the best of the authors' knowledge, these are the first cases of SFA and implant placement via the crestal and lateral approaches in patients with HIV/AIDS.

Case Presentation: A 50-year-old male presented for replacement of missing left maxillary first and second molars. Three-dimensional radiography confirmed the presence of 3 to 5 mm of bone in the ideal implant positions. Lateral-window SFA using a combination of particulate xenograft and allograft resulted in 10 mm of vertical height, allowing simultaneous placement of two implants. Restoration was completed after 6 months of healing. The second patient, a 40-year-old male, presented for replacement of a missing left maxillary first molar. Seven millimeters of native bone allowed a crestal approach for SFA. An oroantral communication was detected intraoperatively after several loads of bone graft had been added, and the decision was made to postpone implant placement. After 2.5 months, implant placement was completed, and the crown was delivered 6 months later. All implant-retained restorations continue to function satisfactorily.

Conclusions: Implant placement with SFA in well-managed patients with HIV/AIDS is a viable treatment option. These case reports add to a growing body of evidence supporting the implementation of the full range of implant therapies in patients with HIV/AIDS. *Clin Adv Periodontics* 2014;4:217-225.

Key Words: Alveolar ridge augmentation; bone regeneration; dental implants; HIV.

Background

A growing number of patients with human immunodeficiency virus (HIV)/acquired immune deficiency syndrome (AIDS) are seeking comprehensive dental therapy, including implants, as a result of improvements in their medical management. The first documentation of dental implant placement in a patient with HIV/AIDS was a case report in 1998.[1] Several other reports followed.[2-7] To date, there have been only two large studies comparing dental implant success in patients with HIV/AIDS and control groups.[6,8] In 2007, Stevenson et al.[6] followed dental implant healing in 29 individuals, 20 of whom were HIV positive. All 15 patients with HIV and nine controls who were followed to the end of the 6-month study showed sound implant healing. Later, a pilot study by Oliveira et al.[8] demonstrated similar healing of dental implants in both

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TABLE 1 Patient Medical History and Dental Information

Patient Information	Case 1	Case 2
Age (years)	50	40
Sex	Male	Male
Year HIV diagnosed	2008	2008
Smoking status	Non-smoker	Non-smoker
HIV-related medications	Combination of 600 mg efavirenz, 200 mg emtricitabine, and 300 mg tenofovir disoproxil fumarate* once daily	300 mg atazanavir sulfate once daily; 100 mg ritonavir once daily; and 300 mg tenofovir disoproxil fumarate once daily
Other medical conditions	History of stomach ulcer (surgically treated in 1987) Penicillin allergy (reaction: hives)	Hypertension Leg spasms Anxiety
Non-HIV medications	None	10 mg hydrochlorothiazide + amlodipine once daily; 5 mg cyclobenzaprine once daily; 5 mg diazepam three times daily; 500/20 mg naproxen once daily; and 20 mg esomeprazole once daily
Laboratory values		
CD4+ T lymphocyte (cells/mm^3)	391	530
Neutrophil count (absolute) ($\times$ 103/μm)	3.3	1.8
Platelet count (per mL)	207,000	278,000
Viral load (copies/mL)	Undetectable	103
Dental history		
Chief complaint	"I need more teeth to chew with."	"I need a dental checkup."
Missing teeth	#14, #15	#14
Date and reason for tooth loss	March 30, 2009: severe non-restorable carious lesions	November 30, 2009: severe non-restorable carious lesions
Residual ridge height	3 to 5 mm	7 mm
Periodontal diagnosis	Generalized slight gingivitis	Generalized slight gingivitis
Other treatment alternatives	No action, removable partial denture, fixed partial denture	No action, removable partial denture, fixed partial denture
Location sinus/implant surgery performed	University of Detroit Mercy Graduate Periodontics Department	University of Detroit Mercy Graduate Periodontics Department
Dates of treatment		
Sinus augmentation	December 2011	July 2011
Implant placement	December 2011	October 2011
Uncovery	April 2012	March 2012
Restorations	August 2012	March 2012

* Atripla, Bristol-Meyers Squibb, New York, New York.

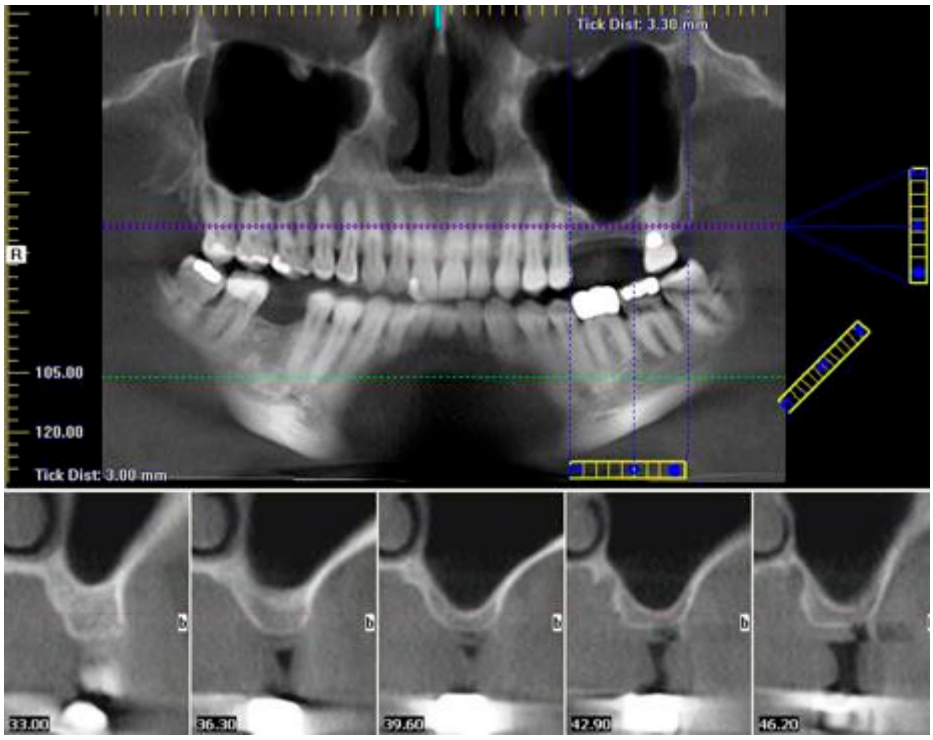

FIGURE 1 Case 1. Lateral approach. Presurgical cone-beam computed tomography of edentulous left maxillary sinus showing minimal residual bone height.

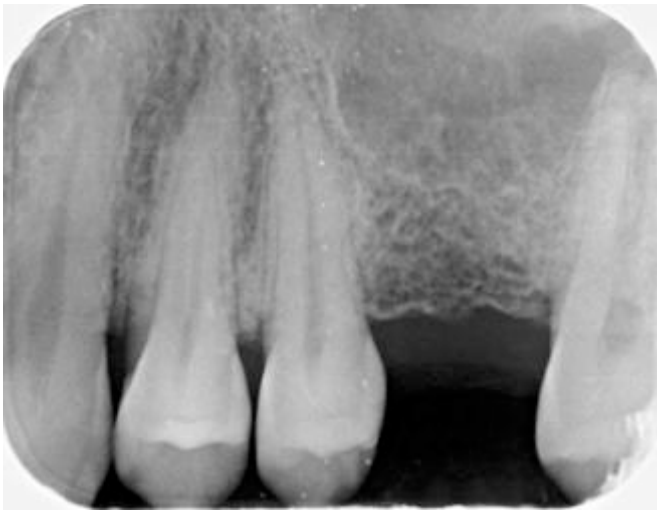

FIGURE 2 Case 2. Crestal approach. Preoperative periapical radiograph of planned implant #14 region.

patients with HIV/AIDS and controls. This study further demonstrated no differences in healing or postoperative peri-implant bone loss when comparing patients with HIV/AIDS receiving different highly active antiretroviral therapy (HAART) regimens.[8]

To aid in implant placement, sinus floor augmentation (SFA) is frequently required in the atrophic posterior maxilla. Simultaneous implant placement with SFA via the crestal or lateral approach offers the advantage of shorter treatment time. Although widely reported in the general population, there is no description of implant placement with SFA in patients with HIV/AIDS. To the best of the authors' knowledge, the first such cases are presented here.

Clinical Presentation

Case 1

A 50-year-old male presented to the University of Detroit Mercy, School of Dentistry Graduate Periodontics, Detroit, Michigan, for replacement of missing teeth #14 and #15. A detailed medical history, including medications and laboratory values, was obtained (Table 1). An extraoral and intraoral clinical and radiographic examination was completed. Cone-beam computed tomography analysis confirmed the presence of adequate horizontal dimension, a lack of septae, and local pathology yet inadequate vertical height (3 to 5 mm) in the ideal implant positions (Fig. 1).

Case 2

A 40-year-old male presented to the University of Detroit Mercy, School of Dentistry Graduate Periodontics for replacement of missing tooth #14. Table 1 summarizes his pertinent medical and dental information. A thorough clinical and radiographic examination was performed and reduced vertical height ($\approx$7 mm) in the region of the planned implant was diagnosed (Fig. 2).

Case Management and Clinical Outcomes

Case 1

On the day of surgery, the patient's medical history was reviewed, vital signs were taken, written informed consent was obtained, and postoperative instructions were reviewed. Table 2 summarizes perioperative medications and regimens. After local infiltration of anesthesia, incisions (crestal, sulcular, and vertical) were made, and a full-thickness mucoperiosteal flap (FTMPF) was elevated. The lateral window was outlined,

TABLE 2 Perioperative Medication Regimens

Medication Class	Medication	Regimen
Antihistamine	Loratadine	Begin 1 week before and continue 2 weeks after surgery
Antibiotic	500 mg azithromycin on day 1 and then 250 mg	Begin 3 days before and continue for 1 week after surgery
Analgesics	600 mg ibuprofen 5 mg hydrocodone/500 mg acetaminophen	Before surgery and every 6 hours for 3 days and then as needed for pain Post-surgery, one to two tablets every 6 hours as needed for breakthrough pain
Oral rinse	0.12% chlorhexidine gluconate	Preoperative rinse and then twice daily for 2 weeks post-surgery

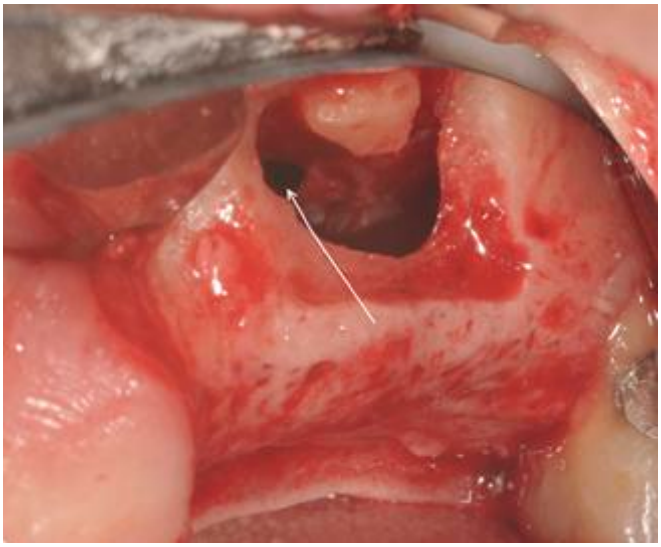

FIGURE 3 Case 1. Lateral-window osteotomy with sinus membrane elevation. Note the Class I perforation (arrow).

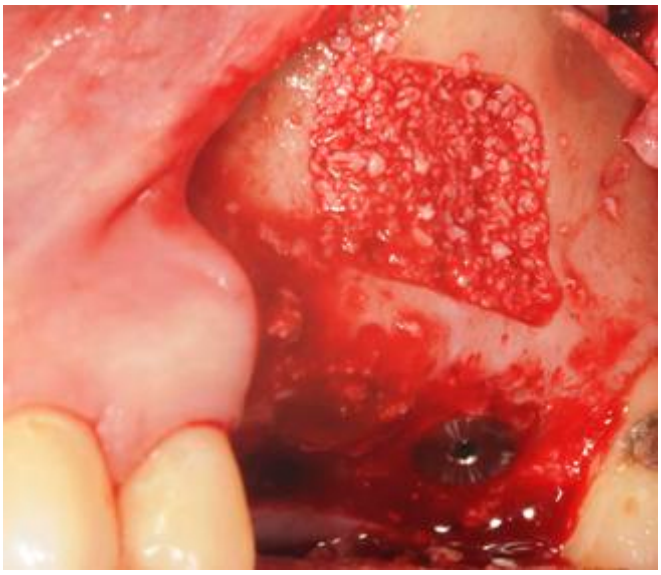

FIGURE 4 Case 1. Composite bone graft of particulate xenograft and demineralized allograft in lateral window and cover screw over implants.

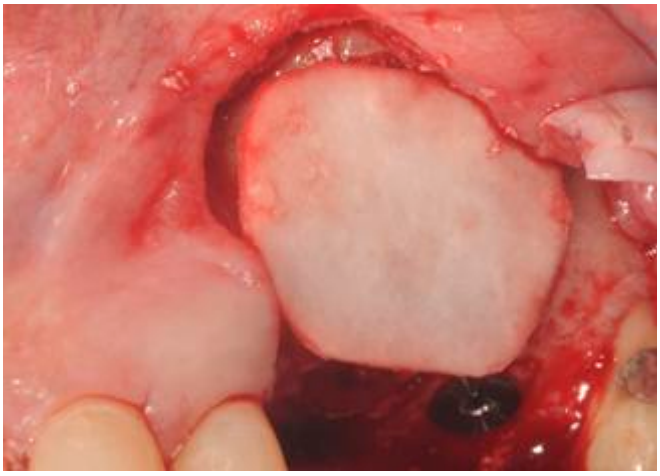

FIGURE 5 Case 1. Resorbable collagen membrane over lateral window.

FIGURE 6 Case 1. Final periapical radiograph of two 13-mm implants in sites #14 and #15. Note tack between the root of tooth #13 and implant #14 used to stabilize the resorbable barrier.

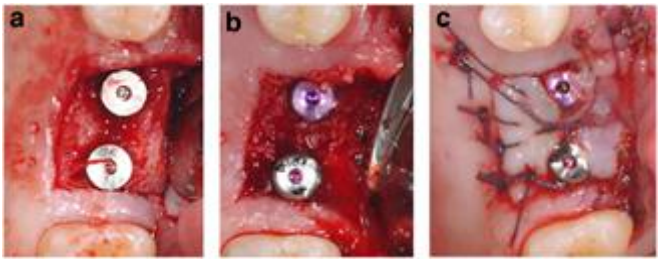

FIGURE 7 Case 1. **7a** Clinical photograph of FTMPF to attach healing abutments. **7b** Mineralized cortical bone allograft around implant #14 with healing abutments on both implants. **7c** Soft-tissue closure around exposed implants.

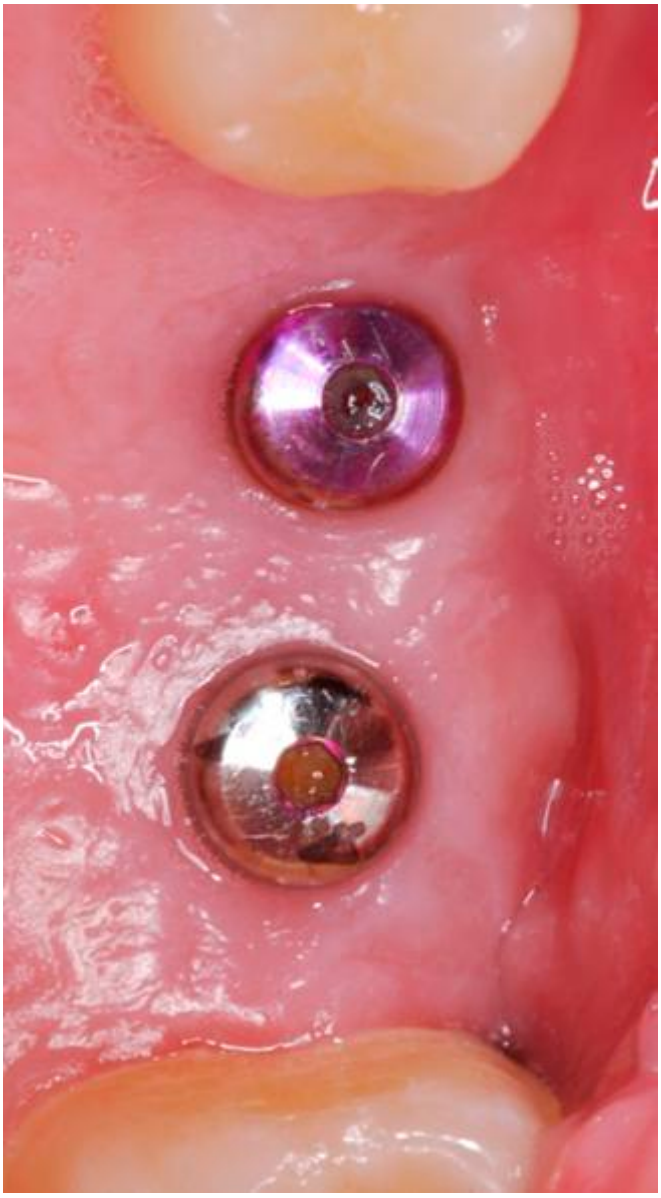

FIGURE 8 Case 1. Soft-tissue healing before restoration at 7 months after implant placement.

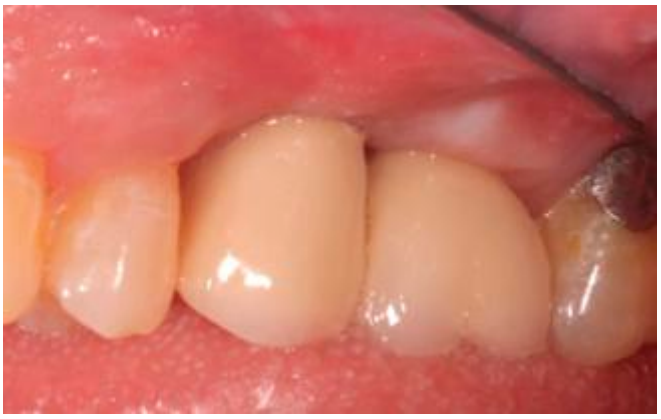

FIGURE 9 Case 1. Final clinical photograph of restored implants.

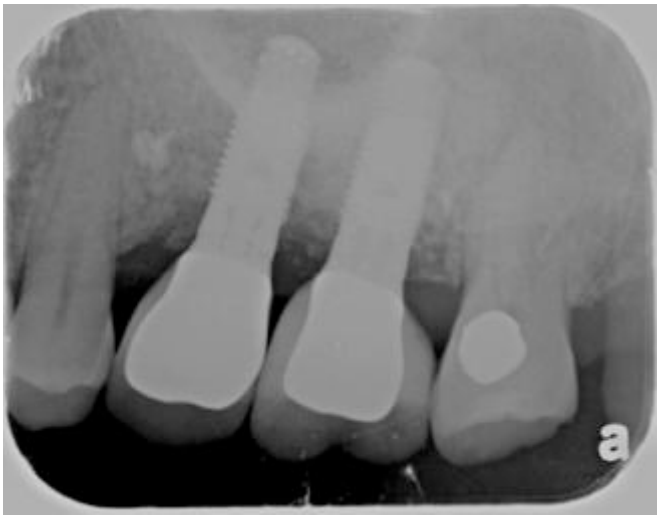

FIGURE 10 Case 1. Final periapical radiograph of implants #14 and #15.

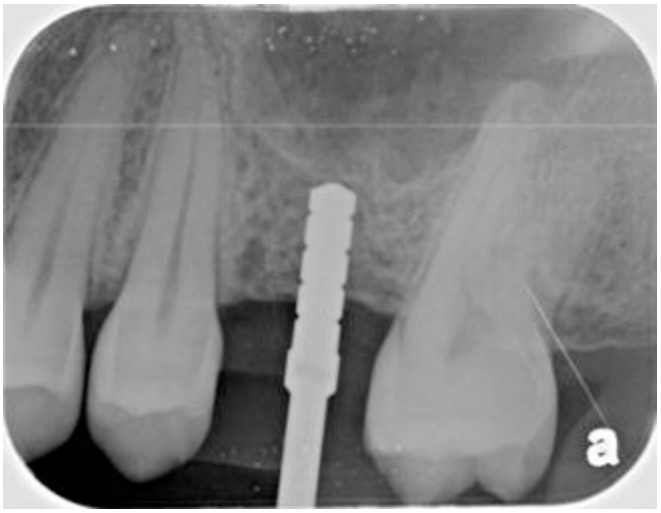

FIGURE 11 Case 2. Direction indicator before SFA and placement of implant at site #14.

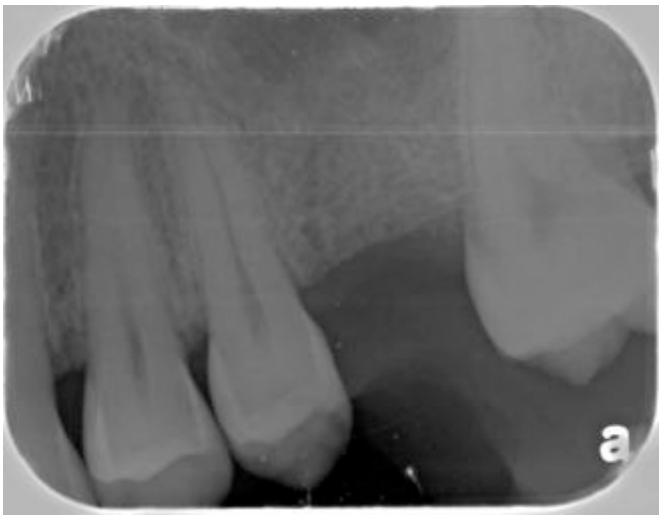

FIGURE 12 Case 2. Periapical radiograph before implant placement demonstrating increased vertical bony height.

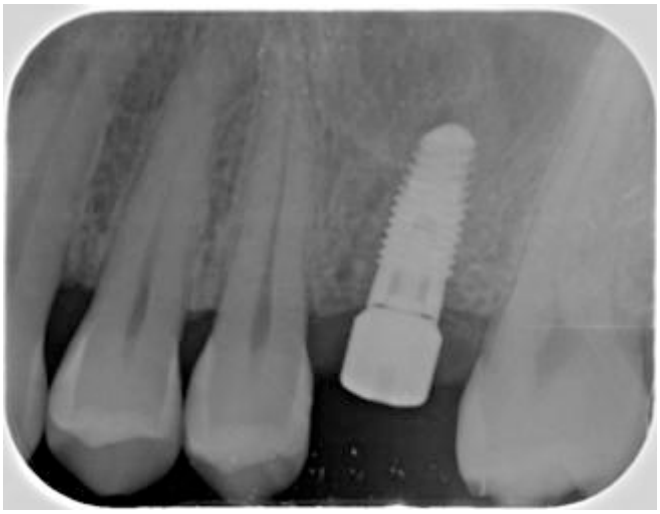

FIGURE 13 Case 2. Final periapical radiograph of implant #14.

and elevation of the sinus lining was initiated. A Class I perforation[9] of the Schneiderian membrane was noted on the anterior superior aspect (Fig. 3, arrow). The perforation was repaired with a collagen membrane[†] and a small amount of bone graft[‡] was placed to stabilize it. The maxillary sinus osteotomies were then prepared using the manufacturer's recommended drill sequence and the dental implants[§] were placed. Additional bone grafts[‖¶] were packed in small increments until sufficient elevation of the sinus floor was obtained (Fig. 4). A second collagen membrane[#] (Fig. 5) was then placed over the lateral wall and secured on the mesial aspect with a titanium tack. Periosteal-releasing incisions were performed to ensure tension-free primary closure. Final periapical (Fig. 6) and panoramic radiographs were taken and postoperative instructions were reinforced. The patient returned 1, 2, and 4 weeks after surgery, throughout which his healing was uneventful (no signs of infection, delayed healing, or prolonged bleeding).

Placement of healing collars was scheduled 4 months after surgery. Updated laboratory values showed minimal change from preoperative measurements. A clinical examination revealed a papule on the buccal aspect corresponding

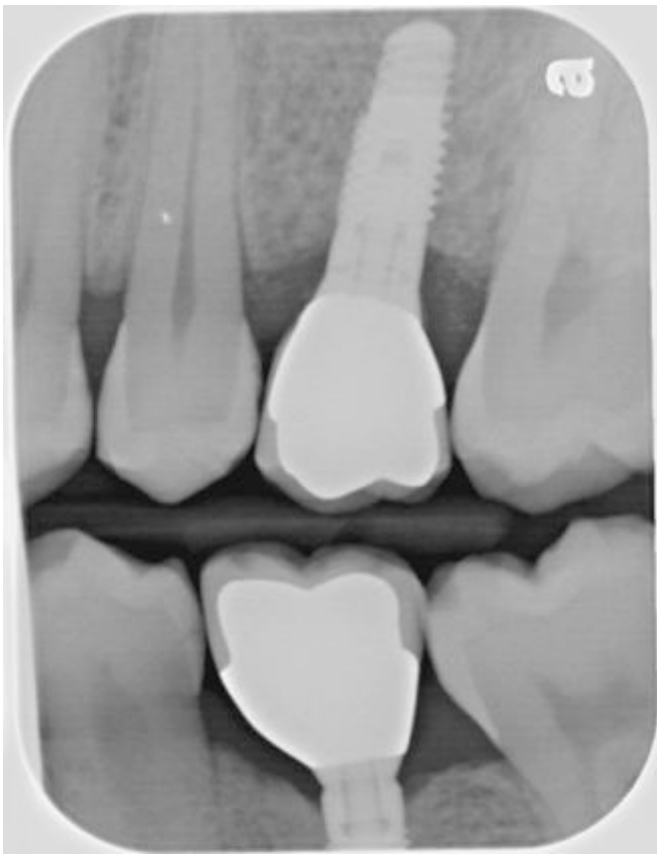

FIGURE 14 Case 2. Final periapical radiograph of restored implant #14. Note the good bone levels and increased vertical height with lack of peri-implant radiolucency.

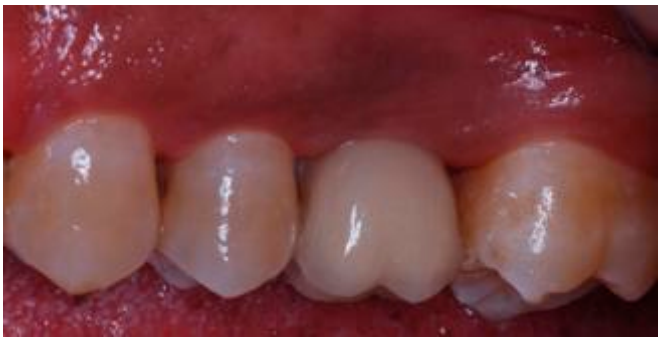

FIGURE 15 Case 2. Final clinical image of implant #14 restoration. Note the good soft-tissue contours and even gingival margins with lack of soft-tissue inflammation.

to the vertical incision made during surgery. The patient reported no discomfort. No swelling or erythema were present, and no exudate was expressed. A periapical radiograph revealed an absence of peri-implant radiolucency. The patient was placed on an antibiotic and returned 1 week later for a scheduled exploratory procedure. At this time, an FTMPF (Fig. 7a) was elevated and no mobility was observed in either implant when cover screws were

[†] BioMend membrane, Zimmer Dental, Carlsbad, CA.
[‡] Bio-Oss, Osteohealth, Shirley, NY.
[§] Tapered Screw-Vent Implant, Zimmer Dental.
[‖] Bio-Oss, Osteohealth.
[¶] DynaBlast, Keystone Dental, Burlington, MA.
[#] BioMend Extend, Zimmer Dental.

replaced with healing collars. Minimal circumferential crestal bone was absent around implant #14 without implant thread exposure. Bone levels were otherwise unchanged. The granulation tissue surrounding implant #14 was removed and replaced with allograft** (Fig. 7b), and the area was closed (Fig. 7c). Seven months after implant placement, a prerestorative clinical examination (Fig. 8) and periapical radiograph confirmed that the implants were osseointegrated. Final restoration was completed at this time (Figs. 9 and 10).

Case 2

On the day of surgery, the patient's medical history was reviewed, vital signs were taken, written informed consent was obtained, and postoperative instructions were reviewed. Table 2 summarizes perioperative medications and regimens. After local infiltration of anesthesia, a crestal incision was made, and the FTMPF was elevated to expose the bony crest. An osteotomy was created to end just short of the sinus floor (Fig. 11) followed by use of osteotomes and bone grafts†††‡ to infracture and lift the sinus floor. The Valsalva maneuver was performed on multiple occasions and was negative. However, a positive Valsalva maneuver was elicited at the end of the SFA procedure. The decision was made to delay implant placement, an extracellular matrix membrane§§ was placed over the osteotomy, and primary closure was achieved. Three months later, a new periapical radiograph (Fig. 12) showed adequate bone height for placement of a 10-mm implant.‖‖ The implant demonstrated primary stability after placement and a 5-mm healing collar was placed (Fig. 13). Restoration was completed 6 months later (Figs. 14 and 15).

Discussion

The literature describing oral surgical procedures in patients with HIV/AIDS is sparse. Of the few documented cases, implants have been placed most often in the mandible or in maxillary regions with sufficient bone to accept an implant.[1-8] However, in clinical practice, it is common that implant placement in the posterior atrophic maxilla requires SFA to augment or obtain additional bone volume. Both crestal and lateral window approaches have proved instrumental in achieving this goal.

According to the most recent systematic review and meta-analysis, the 3-year survival rate of implants placed in the maxillae simultaneously with augmentation via the lateral approach is 90.1%.[10] This success rate increases to 98.3% when only rough surface implants are considered, with a membrane covering the lateral window.[10] In case 1, implants could be placed simultaneously with lateral-window SFA (LWSFA) as a result of increased stability from the more proximal bone. Perforation of the sinus membrane was managed easily. This is the most common complication reported with this procedure (19.5%[10]), yet it does not seem to affect the success of final implant placement.[11,12] Implants placed in a sinus elevated via the crestal technique bear a relatively high estimated survival rate of 92.8%.[13] In case 2, it was decided to delay placement of the implant because radiographs did not show a well-contained bone graft. The finding of a Schneiderian membrane perforation in case 2 was disappointing but not uncommon. As in the lateral approach, membrane perforation is listed as the most frequent surgical complication using the transalveolar technique.[13]

One reason practitioners may hesitate to perform invasive oral surgical procedures in patients with HIV/AIDS is the possibility of postoperative complications. However, Campo et al.[14] documented a relatively low complication rate of 2.2% (overall) to 4.8% (invasive) when dental procedures were performed on patients with HIV.

In both of the present cases, despite finding Schneiderian membrane perforations, implant healing proceeded uneventfully. All implant-retained restorations continue to function satisfactorily. The present authors acknowledge that this report demonstrates only a short-term outcome. Long-term controlled clinical trials are needed to confirm that SFA in combination with implant placement is as predictable in patients with HIV/AIDS as it is in the general population. This is important given the increasing number of people with HIV/AIDS enjoying longer lives as a result of better medical management, which includes HAART. ■

** Mineralized cortical bone, Musculoskeletal Transplant Foundation, Edison, NJ.
†† Bio-Oss, Osteohealth.
‡‡ DynaBlast, Keystone Dental.
§§ DynaMatrix, Keystone Dental.
‖‖ Tapered Screw-Vent Implant, Zimmer Dental.

Summary

Why are these cases new information?	■ To the best of the authors' knowledge, this is the first documentation of simultaneous dental implant placement and LWSFA in patients with HIV/AIDS. ■ Also to the best of the authors' knowledge, this is the first documentation of SFA via the crestal approach in a patient with HIV/AIDS.
What are the keys to successful management of these cases?	■ Collaboration with medical colleagues to ensure stable pertinent laboratory values ■ Management of sinus perforation in the LWSFA approach with a resorbable barrier ■ Primary stabilization of implants placed simultaneously with LWSFA ■ Ensuring graft containment before implant placement (case 2)
What are the primary limitations to success in these cases?	■ Sinus perforation (case 2) ■ Lack of ability to visualize sinus lining and bone graft (case 2)

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○ indicates key references.