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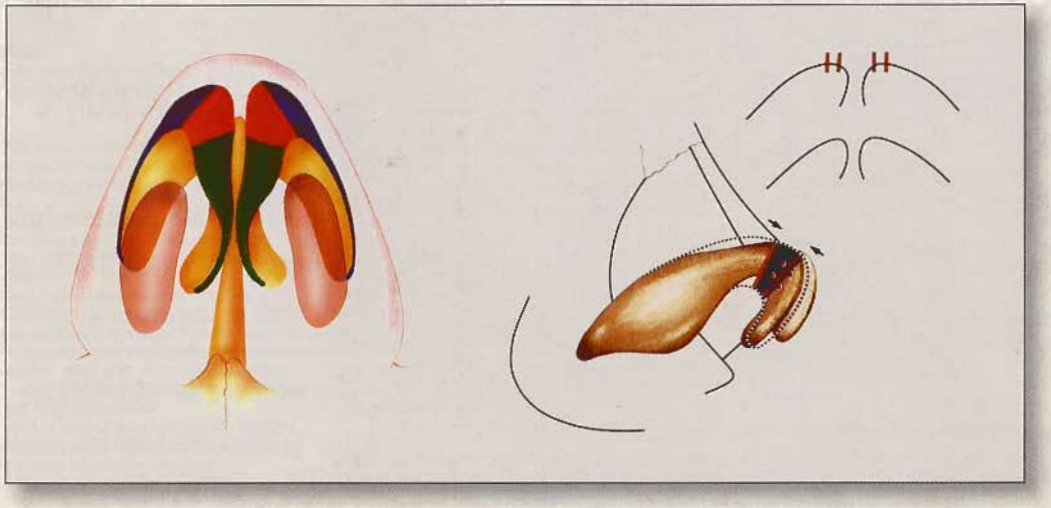

Tripod arch and vertical lobular division. See page 16.

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The Use of Custom-Designed Midfacial and Submalar Implants in the Treatment of Facial Wasting Syndrome

William J. Binder, MD; David C. Bloom, MD

Facial wasting syndrome is part of a lipodystrophy that occurs as a complication of highly active antiretroviral therapy. The loss of subcutaneous fat in the cheeks and temples results in a hollow-eyed, bony, emaciated appearance that is characteristic of the results of treatment of human immunodeficiency virus. Cessation of therapy results in a rebound in viral load and subsequent morbidity. The appearance of facial wasting syndrome is optimally treated with custom-designed implants that are made using high-resolution computed tomography combined with surgeon input and computer-aided design and manufacturing technology. Twenty-two patients with facial wasting syndrome were treated using either submalar implants (in more moderate cases) or custom-designed implants (in more severe cases). In each patient, the appearance of volumetric soft tissue restoration was successfully achieved, returning a permanent and more healthful appearance to the face.

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Facial atrophy can occur with age or as a result of underlying illness. It is influenced by multiple factors, including facial bone structure, skin quality, facial adiposity, and overall health. Wasting was an early identifying characteristic of human immunodeficiency virus (HIV) infection originally termed *slim disease* in Africa.[1] It is defined by the Centers for Disease Control and Prevention as the involuntary loss of more than 10% of baseline body weight in combination with diarrhea, weakness, and/or fever and is considered an AIDS-defining illness.[1] Highly active antiretroviral therapy (HAART) decreases HIV-associated wasting, morbidity, and opportunistic infections; increases body cell mass; and improves survival and quality of life.[2] However, with HAART, many patients will develop a syndrome of peripheral fat wasting known as *facial wasting syndrome* (FWS), which involves the extremities and face, central and cervicodorsal fat pad adiposity, hyperlipidemia, and insulin resistance.[3] After 14 months of treatment with protease inhibitors, as many as 64% of patients infected with HIV develop this lipodystrophy and subsequent FWS.[4] The loss of subcutaneous fat in the cheeks and temples results in the typical bony, emaciated appearance that is characteristic of HIV infection. Cessation of HAART is unlikely to improve facial wasting, while allowing an increase in drug-resistant strains of HIV, viral-load rebound, and increased morbidity and mortality.[4]

As patients with HIV live longer and healthier lives, many of them are beginning to seek surgical correction of the cachectic appearance caused by FWS. In such patients, traditional soft tissue augmentation modalities have limited success. Traditional rhytidectomy techniques with fat suspension have been tried but are generally not successful in cases in which there is severe atrophy.[4] Dermal fat grafts, local flaps, and free flaps have all been used, but they require multiple fields and long procedures.[4,5] Local injection with synthetic soft tissue fillers such as polylactic acid (New-Fill, or Sculptra) has been attempted and shows promise.[4,6] However, in the severe cases, the quantity of material needed to fill the defect, the need for frequent injections, and the maintenance cost to the patient make this therapy less than optimal. The frequent coexistence of central and cervical lipodystrophy would seem to provide an ideal source of fat for transfer. Unfortunately, these areas frequently have extremely fibrous fat, which often requires ultrasonic liposuction for removal and is unsuitable for

Author Affiliations: Department of Head and Neck Surgery, UCLA David Geffen School of Medicine, University of California, Los Angeles (Dr Binder); and Department of Otolaryngology–Head and Neck Surgery, University of Washington, Seattle (Dr Bloom).

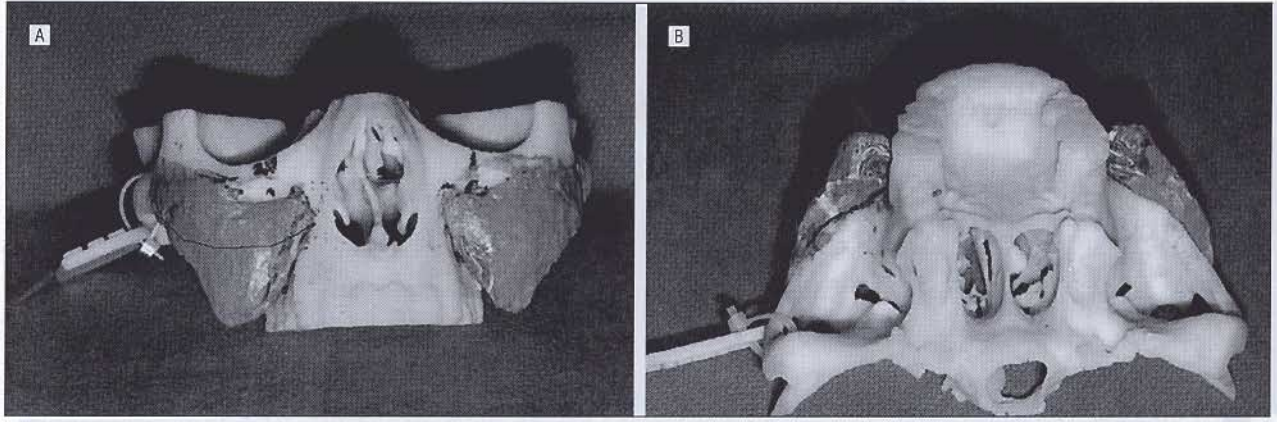

Figure 1. High-resolution computed tomographic 3-dimensional computer-aided design and computer-aided manufacture (CAD/CAM) model demonstrating the fabrication of custom-designed silicone midfacial implants that are used to correct the characteristic appearance of facial wasting syndrome. A, The line on the right side of the model indicates the inferior border of the maxillary bone. B, Note the thickness of the implant (9 mm).

transfer.[4] Fat injections also present unpredictable results, may cause irregularity, and may require frequent injections. Collagen and other injectable fillers (eg, Restylane, Perlane, Cosmoderm, and Cosmoplast) are short-lived and expensive and do not adequately address the volumetric or aesthetic needs of patients with FWS.

Solid synthetic volumetric midfacial implants provide durable surgical reconstruction for this problem. Talmor et al[4] used submalar silicone implants in 3 patients to correct FWS. One patient required repositioning of the implant after mild displacement, and 2 patients required additional soft tissue augmentation of the nasolabial fold before surgeon and patient satisfaction were achieved. Talmor and colleagues found that the facial wasting was due to subcutaneous fat atrophy, with the deeper fat pads being maintained. In contrast, our experience revealed that atrophy occurs in both the superficial subcutaneous fat and the deeper buccal fat pads.

Alloplastic implants can be used for aesthetic and reconstructive facial augmentation.[7] Submalar Silastic implants can enhance the bony scaffolding of the midface, resulting in increased midface soft tissue projection and better support of buccal and superficial musculoaponeurotic tissues.[8,9] Custom implants are ideal because they can be designed to meet the specific bony and soft tissue needs of the patient, conform to the underlying bony irregularity, and be surgically placed to remain stable without fixation.[4,10,11]

Computer-aided design and computer-aided manufacture (CAD/CAM) tools combined with data from high-resolution computed tomography have enabled the production of custom-designed alloplastic implants (3D Accuscan; Implantech Associates Inc, Ventura, Calif).[1] In this process, an acrylic 3-dimensional bony model of the skull is generated from the computed tomographic data with the use of laser crystallography technology. The surgeon can then examine and study a life-size plastic model in detail and determine areas that need augmentation. A moulage of the face is also made to help in estimating the amount of soft tissue deficit that the implant will need to replace. The desired size and shape of the implant are then contoured onto the bony model (**Figure 1**). The model and implant template are then sent to the implant manufacturer for fabrication of the actual implant. Therefore, a customized facial implant is produced based on accurate preoperative diagnosis, surgeon-designed implant countour and thickness, and precise manufacturing techniques.

METHODS

A retrospective review of the senior author's (W.J.B.) experience using custom-designed midfacial or submalar implants in 22 patients with HIV and FWS was performed.

SURGICAL TECHNIQUE

Perioperative antibiotics are administered. The intraoral route is used for placement of the implants. After infiltration of the anesthetic solution, a 1.0- to 1.5-cm incision is made through the mucosa and carried directly down to bone in a vertical oblique direction above the buccal-gingival line and over the lateral buttress. The incision is made high enough to leave a minimum of 1 cm of gingival mucosal cuff to facilitate closure. A 10-mm-wide Tessier-type elevator is directed through the incision onto the bone in the same orientation as the incision within the subperiosteal plane. With the elevator being kept directly on bone, the soft tissues are elevated upward off the maxillary buttress and the malar eminence. The opposite, or free, hand is used to help guide the elevator over the designated area. (The key to the procedure is exposing the submalar space in its most inferior dimension.) The submalar space is then exposed by elevating the soft tissues inferiorly over the masseter muscle, below the maxilla, and over the masseter muscle to create a soft tissue pocket for the inferior portion of the implant. The masseter muscle is not cut, leaving a supporting framework on which the implant can rest. If necessary, the submalar space may be extended posteriorly along the zygomatic arch using blunt dissection to allow an implant with a posterior extension to fit passively within the space. In cases of midfacial atrophy, the implant resides only partially on bone, with the major portion of the implant extending inferiorly over the masseter muscle (Figure 1A). Once the custom-designed implant is in position, the precise fit between the posterior surface of the implant and underlying bone directs the implant into the correct anatomical position. When off-the-shelf submalar implants are used, the implants can be positioned and stabilized with various methods of fixation. One reliable

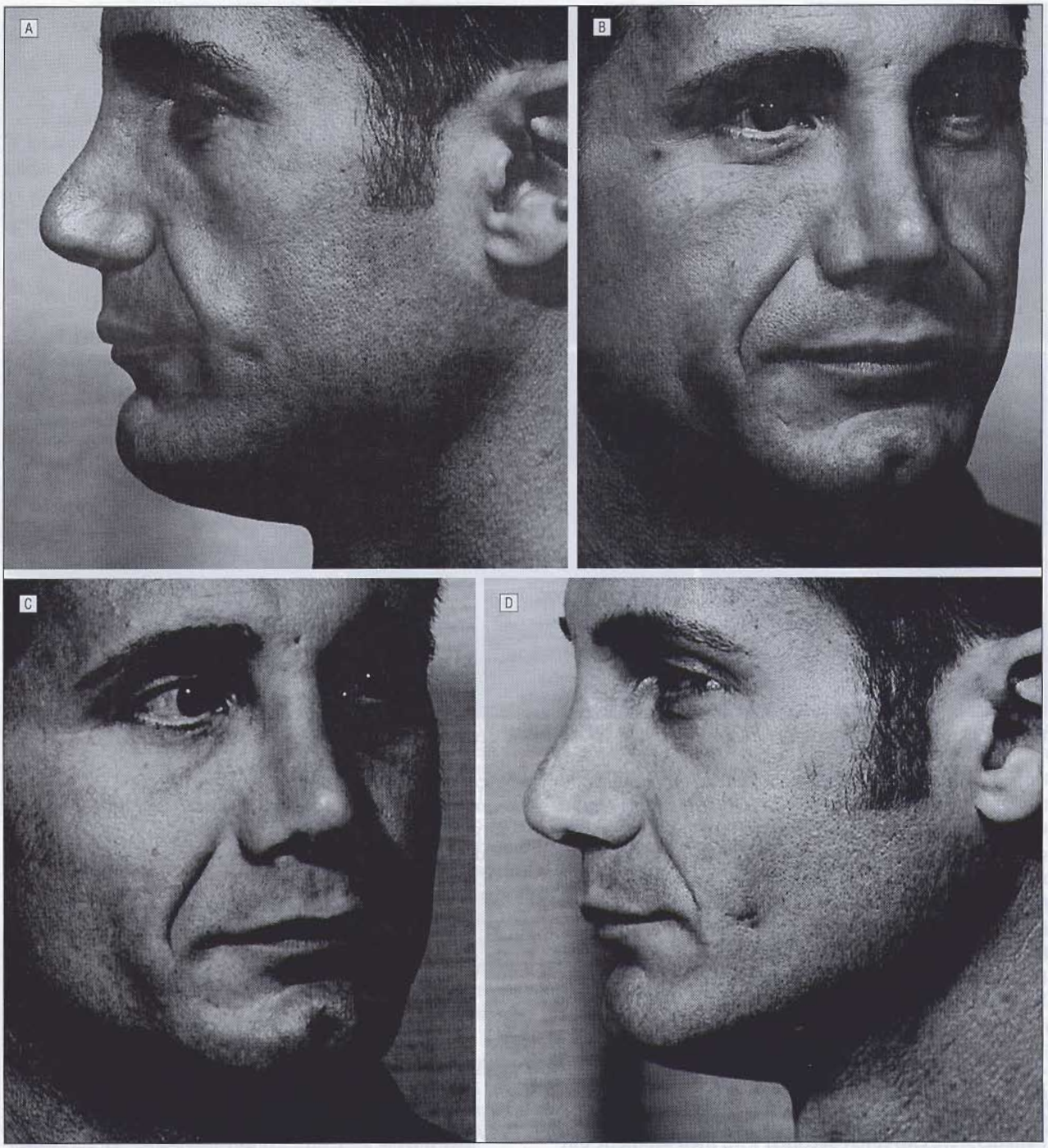

Figure 2. A 38-year-old man before (A and C) and 9 months after (B and D) implantation of custom-designed midfacial implants.

method involves the use of a percutaneous suture and bolster.[7] Frequent irrigation is performed with bacitracin 50 000 U/L of isotonic sodium chloride solution. The incision is closed with simple interrupted sutures, and the patient is closely followed up for 48 hours. A Spandex mask is used to apply even compression over the midface and then removed in 24 to 48 hours.

RESULTS

Overall, 22 patients had excellent aesthetic postoperative outcomes as determined by the patient and the surgeon. Fourteen of the 22 patients received custom implants for more severe midfacial changes, and 8 patients received "off-the-shelf" submalar implants for midfacial conditions of moderate severity. In severe cases of FWS, the custom implants are preferred because of the need to produce a more vertical, triangular-shaped, and thicker implant, which is positioned in a more medial position than in routine midfacial augmentation procedures. In these severe cases, which require large implants, some patients experience a minor limitation in superior oral commissure excursion on extreme smiling. This limitation is a result of the mass effect of the implant. All of

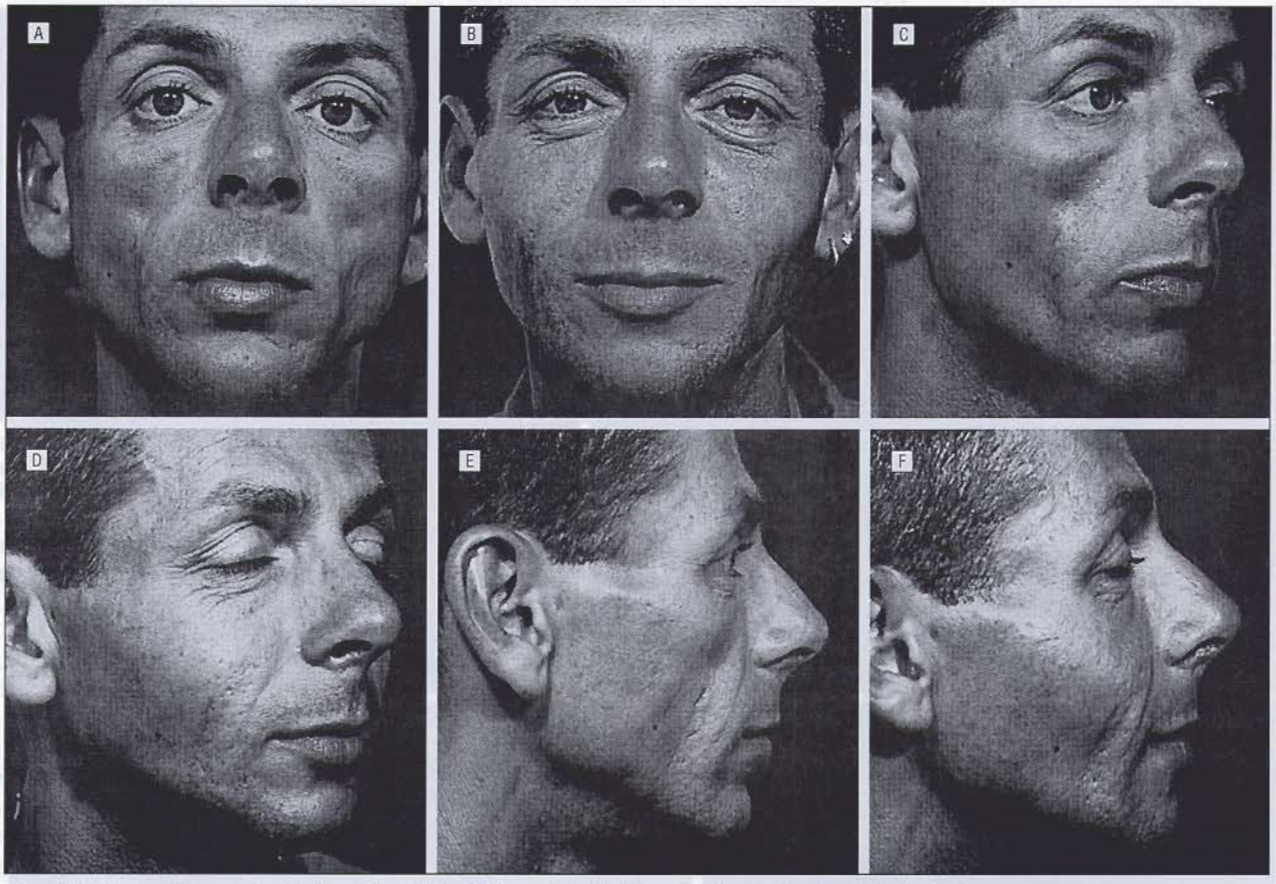

Figure 3. A 33-year-old man before (A, C, and E) and after (B, D, and F) implantation of custom-designed midfacial implants.

our patients were counseled preoperatively about the functional significance of the implants. Postoperatively, however, none of the patients indicated that the limitation during extreme smiling was in any way problematic or of any consequence compared with the overall positive results that were obtained. There were no serious complications, such as permanent infraorbital paresthesia, facial nerve paralysis, implant migration, displacement, or extrusion. One patient presented with a postoperative wound infection that required implant removal. After oral antibiotic therapy was initiated, the implant was replaced in 3 weeks, without subsequent problems. In 1 case, there was a delayed wound infection, which required removal of the implant. The patient subsequently decided not to replace the implant. All the other patients were extremely satisfied with their aesthetic outcome and would highly recommend the procedure to other patients with FWS (**Figure 2** and **Figure 3**).

CONCLUSIONS

The dramatically improved therapy provided by HAART has enabled patients with HIV to live longer and healthier lives. Human immunodeficiency virus is not the death sentence that it once was. As a result, many patients are seeking correction of the bony, emaciated appearance of FWS, which occurs in more than 50% of patients who receive HAART for longer than 1 year. Custom-designed submalar implants provide a safe, stable, definitive, aesthetically pleasing solution to this problem.

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Correspondence: William J. Binder, MD, 120 S Spalding Dr, Suite 340, Beverly Hills, CA 90212 (info@doctorbinder.com).

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