pander migration and extrusion, and improving aesthetic outcomes.[2]

I also strongly agree with the authors that the use of acellular dermal matrix can in some cases lead to complications that are bothersome and difficult to deal with. I would like to share my technique for intraoperative acellular dermal matrix placement, which has allowed me to minimize complication rates. This includes both steps to determine whether acellular dermis is appropriate for the patient, and techniques used to minimize the incidence of seroma and infection.[3]

As in most procedures, I agree with the authors that patient selection is critical for achieving good results. In most cases, obese patients and those with preoperative macromastia are deemed to be poor candidates for acellular dermis–assisted reconstruction. Even with aggressive flap trimming and large intraoperative expander fill volumes, those with redundant mastectomy flaps will present an increase in dead space over the acellular dermis, thus increasing seroma rates. Similarly, those patients with evidence of excessive vascular insult to the flaps following mastectomy, or extremely thin flaps with significant amounts of exposed dermis on the underside, are offered a fully submuscular reconstruction. These patients lack sufficient flap vascularity to allow for acellular dermal matrix revascularization. In addition, they will often require aggressive mastectomy flap débridement and will likely not tolerate the excessive filling of the expander afforded by the acellular dermis.

Those patients undergoing nipple-sparing mastectomy are usually treated with submuscular tissue expander placement. To maximize nipple and areola viability, they are not expanded aggressively at the time of mastectomy. Thus, they will usually stand to benefit little from the increased intraoperative fill volume offered by acellular dermal matrix.

For those patients proceeding to acellular dermis–assisted breast reconstruction, maintaining unflappable sterile technique while handling the product is of utmost importance. The dermal matrix is handled by only one surgeon, after either changing or cleansing of the gloves. Furthermore, the product is taken from the saline bath where it is soaking and placed directly in the wound. As such, it does not contact either the operative field or the patient's skin. This further reduces the potential for contamination.

As the authors have alluded to, I agree that both vigilant antibiotic management and drain management are crucial. My patients remain on antibiotics to cover Gram-positive skin flora for a 14-day period. In addition, two drains are crucial for each breast. When no portion of the implant pocket is left open, a drain is placed within the acellular dermis/pectoralis major pocket. In addition, every effort should be made to allow the course of at least one drain to traverse the dissected portions of the axilla.

Like the authors, I am always careful not to overexpand intraoperatively. While the use of acellular dermal matrix has afforded us higher intraoperative fill volumes, aggressive expansion to the point of excessive skin stretch will lead to blunting of microcirculation and resultant mastectomy flap necrosis.[4] Thus, the expander must always be filled to a point where there remains no tension on the overlying skin flaps.

Finally, the acellular dermal matrix has a distinct polarity, and this must be identified intraoperatively. The "dermal side" can be identified by its smooth, shiny appearance. In addition, this side appears to absorb blood that it contacts. It is crucial that this side be placed up, such that it contacts the underside of the mastectomy flap rather than the implant. This side has been shown to be more likely to revascularize and is potentially more seromagenic, and is thus kept away from the implant. This is in contrast to the "basement membrane side," which is dull and rough in appearance, and appears to repel blood that it contacts. This side is placed down, such that it contacts the expander.

Although prevention of all seroma and infection in any technique for breast reconstruction is not possible, it is my belief that following the steps described here have helped me to reduce such occurrences. I again thank Dr. Bonomi et al. for their insight into this always evolving technique and for sharing their expert opinions.

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DISCLOSURE

The author has no financial interest in any of the products, devices, or drugs mentioned in this communication.

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The New Age of Three-Dimensional Virtual Surgical Planning in Reconstructive Plastic Surgery

Sir:

It was with great pleasure that we read your recent article entitled "Use of Virtual Surgery and Stereolithography-Guided Osteotomy for Mandibular Reconstruction with the Free Fibula."[1] We commend the authors, Antony et al., for their exciting work

using three-dimensional imaging technology to further enhance free fibula reconstruction of the mandible. In their study, they report their experience with five patients who underwent composite mandibular resection with the aid of virtual planned reconstruction. They report 100 percent success with the use of cutting guides to direct oncologic resection and fibula reconstruction of the mandible. We congratulate this group for their ongoing work in bringing to light an exciting area of plastic and reconstructive surgery.

Our group first described the use of virtual planning for fibular reconstruction of the mandible in 2009,[2] and virtual three-dimensional planning continues to rapidly be adopted as a novel technique for reconstructive plastic surgery. Since this report, the authors along with a number of other surgeons worldwide have continued to explore the potential of virtual planning to other areas of reconstructive surgery, including craniofacial surgery and posttraumatic deformities.[3]

To date, we have gained over 3 years of experience with virtual planning in free-fibula mandible reconstruction with a total of 75 patients at our two institutions. Although our first generation of virtual planning in the fibular reconstruction of the mandible represented a similar approach as described by Antony et al., we feel that it is important to point out for the readers of *Plastic and Reconstructive Surgery* the critical advancements that have been made.

Both Antony et al. and our group initially report the use of cutting and positioning guides to aid in both resection and reconstruction. One important feature that currently exists and that has yet to be reported in the literature is the placement of dental implants at the time of initial surgery. We have found that through virtual planning the surgeon has the capability to plan and in turn directly place implants onto the fibular segment while attached to the pedicle before final division. With virtual planning, one has the capability to determine the true dimensions of the patient's fibula and the ability to successfully place implants. If concerns for bone stock do arise, one can then plan for a double-barreled free flap to be used. We have found virtual planning to be particularly helpful in such cases where double-barreling is required and that otherwise may be difficult to "free hand" from a three-dimensional perspective.

Perhaps the most significant advance that we have now made with this technology is planning of not only the initial implant but also the prosthesis. With careful preoperative virtual planning among the prosthodontist and the oncologic, plastic, and oral and maxillofacial surgeons, three-dimensional virtual technology now affords the ability to plan and construct a fibula with implants and a dental prosthetic as a single-stage procedure. In this regard, a patient undergoing composite mandible reconstruction leaves the operating room with a full complement of teeth. An example of this type of reconstruction is shown in Figure 1.

An important criticism of the work by Antony et al. is the lack of any objective data comparing "virtual" plan to surgical outcomes. Roser et al. recently published their

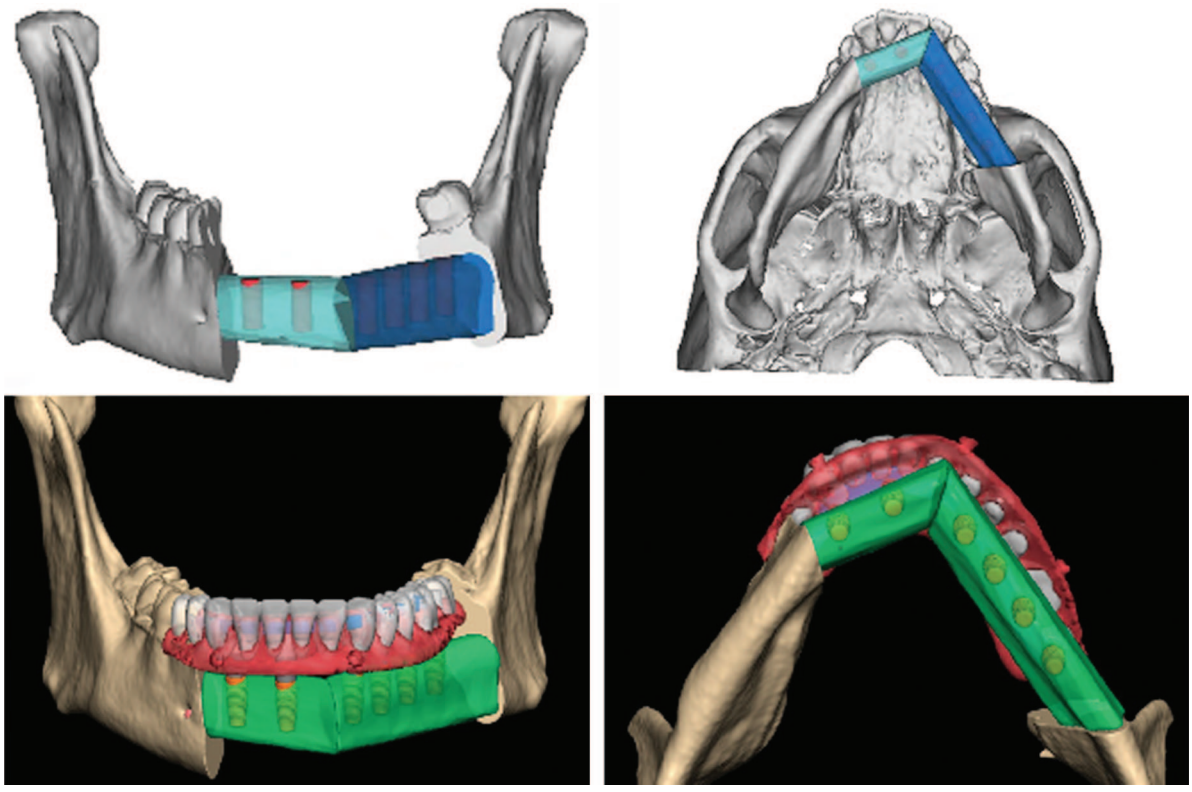

Fig. 1. Reconstruction using three-dimensional virtual technology.

review of 11 patients who underwent virtual planning for free-fibula reconstruction of the mandible.[4] Three-dimensional comparisons demonstrated a mean overlap of 59 percent, with minimal deviation from the planned reconstruction. This type of analysis is essential as this technology evolves, as is the study of other important parameters such as operative time and total cost.

We hope this discussion adds to the ongoing work by various physicians worldwide using virtual planning in reconstruction of the jaw. We look forward to other exciting reports from such groups and await critical review of this technology in years to come.

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Reply: The New Age of Three-Dimensional Virtual Surgical Planning in Reconstructive Plastic Surgery

Sir:

We welcome an opportunity to respond to Tepper et al.'s letter regarding our recent article in *Plastic and Reconstructive Surgery* on virtual planning for fibular reconstruction of the mandible.[1] We thank them for their appreciation of our institution's ongoing efforts, in concert with our prosthetic department and craniofacial center, to develop creative techniques incorporating virtual planning to advance and develop the science of predictable, successful surgical outcomes.

We are certainly aware of the New York University group's promising work in this area and previous experience (cited in our reference list).[2] Our institution is also working to advance the technology with prediction of osteointegrated implants and maxillofacial procedures (e.g., bilateral sagittal split osteotomy, Le Fort) in "single-stage" head and neck reconstruction. Increasing multicenter experience certainly lends itself to opportunities to learn from one another and outcomes-centered collaboration.

We agree that objective measures to assess virtual surgical planning technology need to be developed. Our study incorporated several objective measures, including technical accuracy using volumetric overlap analysis using three-dimensional computed tomographic image overlay of the virtual plan, native mandible and reconstructed mandible, and functional [Panorex (S. S. White Technologies, Inc., Piscataway, N.J.), occlusion] outcomes. Rosner et al.[3] demonstrated in their series that a mean percentage volume of the actual to planned fibula of 91 percent, mean distance of actual to planned osteotomy of 2 mm, and mean percentage overlap of the actual to virtual plate of 59 percent. Although these parameters ensure fidelity of the technology and expose limitations, certainly translating these measures to accuracy of the planning session in achieving functional outcomes is perhaps more important. Thus, we chose to assess technical accuracy with overlap of native, planned, and neomandible and functional outcomes with Panorex and occlusion, although we anticipate more precise scales of measurement as familiarity with the use of this technology expands.

As progress in virtual surgery continues to be acknowledged and integrated at centers in the United States and around the world, newer applications and improvements of existing concepts are constantly presented. This is an exciting time in this evolving frontier of craniomaxillofacial surgery. We hope to be able to serve as part of the joint effort and further expose the potentials of this technology, thereby enhancing intraoperative efficiency, reducing medical error, and overall improving patient outcomes.

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