

# Optimizing Aesthetic Outcomes in Autologous Breast Reconstruction: 20 Pearls for Practice

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**Summary:** Autologous breast reconstruction with a deep inferior epigastric artery perforator (DIEP) flap is an excellent option for many patients proceeding with mastectomy for surgical management of their breast cancer. As microsurgical techniques and results improve and ensure consistent flap survival, optimizing aesthetic outcomes may become a primary focus. This article outlines 20 tips that can improve aesthetic results in DIEP flap breast reconstruction, based on our senior author's 8-year career in microsurgical breast reconstruction, with an emphasis on enhanced cosmesis. We highlight tips on preoperative planning, intraoperative, and revision stages of the reconstruction and provide a schematic for integrating the tips into a reader's microsurgical breast reconstruction practice. (*Plast Reconstr Surg Glob Open* 2024; 12:e5750; doi: [10.1097/GOX.0000000000005750](https://doi.org/10.1097/GOX.0000000000005750); Published online 17 April 2024.)

## INTRODUCTION

Autologous breast reconstruction (ABR) remains an excellent option for many patients proceeding with mastectomy for surgical management of their breast cancer. Although performed less frequently than implant-based reconstruction (IBR), a recent meta-analysis by Stefura et al including a total of 55,455 patients demonstrated that patients who underwent ABR are more satisfied with their reconstructed breasts and the overall outcome of their breast reconstruction treatment than patients who underwent IBR.<sup>1</sup> Satisfaction was quantified based on reported BREAST-Q outcomes.<sup>1</sup> Additionally, in the subset of breast cancer patients requiring postmastectomy radiation therapy as a part of their treatment, ABR offers lower rates of complications requiring reoperation and reconstructive failure than does IBR.<sup>2</sup> The deep inferior epigastric artery perforator (DIEP) flap remains the gold standard and mainstay of ABR. DIEP flap surgery can provide natural-looking, long-lasting outcomes with exceptional aesthetic results. In this article, we describe an approach to DIEP flap ABR, from the perspective of our senior author, a breast microsurgeon with particular interest in optimizing aesthetic outcomes to improve patient satisfaction.

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## BACKGROUND

When meeting with a new patient opting for breast reconstruction, many surgeons would say that the goal of surgery is to achieve a symmetric result in clothing. After all, scars and minor imperfections can be hidden by a well-fitting brassiere. Over time, the goal shifts as our techniques and results improve. We should consider amending our objective to make patients feel comfortable without clothing. In our practice, this mindset has pushed us to constantly improve our results to meet patient expectations and give them a reconstruction outcome they can feel positive about when they look in the mirror.

When first beginning breast microsurgery practice, the primary goal is flap survival. Over time, as surgeon's microsurgical skills and confidence improve, focus can be shared between flap viability and cosmesis. "Hooray, the flap lived! Now, how do I make it look good?" Optimizing the aesthetic outcome has become a focus of the senior author's practice. Scrutiny of early career DIEP flap results helped identify areas for improvement and has led to superior cosmetic results. Over time, we have fine-tuned our DIEP flap technique based on constant critical appraisal of surgical outcomes. In 2023, our senior author performed 77 DIEP flaps in 53 patients at a high-volume center with a total of five breast microsurgeons. Here, we share lessons learned to provide reproducible tips and tricks that can dramatically enhance results.

Ultimately, the most important advice to share is that details matter. Small things have meant the difference between acceptable and great. This article outlines 20 tips that can improve aesthetic results in DIEP flap breast

Disclosure statements are at the end of this article, following the correspondence information.

reconstruction. A schematic for implementing these tips during different stages of the reconstruction is given in Figure 1. Surgical results by the senior author are displayed in Figures 2–7.

## PEARLS FOR PRACTICE

### Preoperative Planning

#### Number 1: Visualize Your Final Result

Plan for the final reconstruction from the beginning. During the initial consultation, envision what will provide the optimal result and work backward. This begins with selecting the appropriate tissue expander for staged

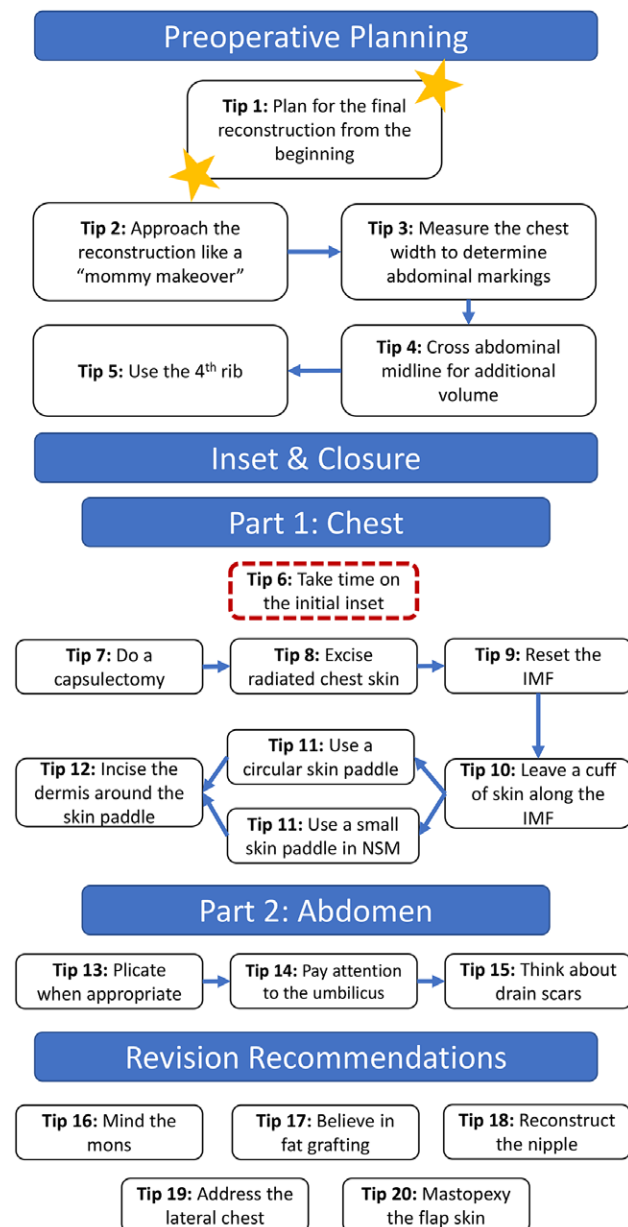


Fig. 1. Schematic representation of our 20 pearls for practice.

### Takeaways

**Question:** How can one optimize aesthetic results of deep inferior epigastric artery perforator flap breast reconstruction?

**Findings:** This article outlines 20 tips that can improve aesthetic results in deep inferior epigastric artery perforator flap breast reconstruction, based on our senior author's 8-year career in microsurgical breast reconstruction, with an emphasis on enhanced cosmesis.

**Meaning:** We highlight tips on preoperative planning, intraoperative, and revision stages of the reconstruction and provide a schematic for integrating the tips into a reader's microsurgical breast reconstruction practice.

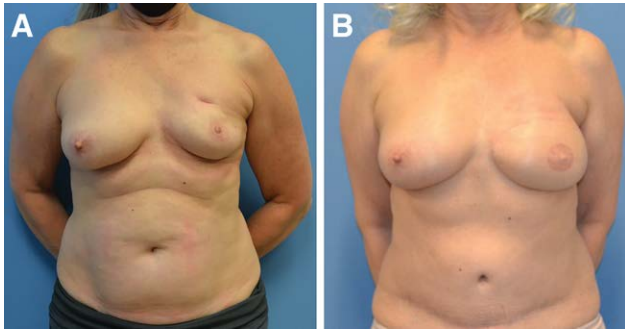
reconstruction to prevent over-expansion of the skin envelope, which could create a mismatch between the breast pocket and the flap size. It may also be beneficial to use a Wise pattern mastectomy to reduce a large skin envelope and correct breast ptosis for the same reason. Communication with the breast oncology team performing the patient's mastectomy is paramount, so the patient can be appropriately positioned for a safe oncologic outcome in addition to an aesthetic reconstruction. Finally, consider setting a body mass index (BMI) goal for patients to achieve before their flap surgery, in the case of delayed reconstruction. We use a BMI goal of 35 kg per m<sup>2</sup> to reduce the risk of complications and achieve a superior cosmetic outcome.<sup>3</sup> Most of our patients undergo a delayed DIEP flap reconstruction, which allows the patient time to pursue weight loss should they have a BMI higher than the goal. We help facilitate this by referring patients to our hospital weight management program, if interested.

#### Number 2: Use a Cosmetic Approach

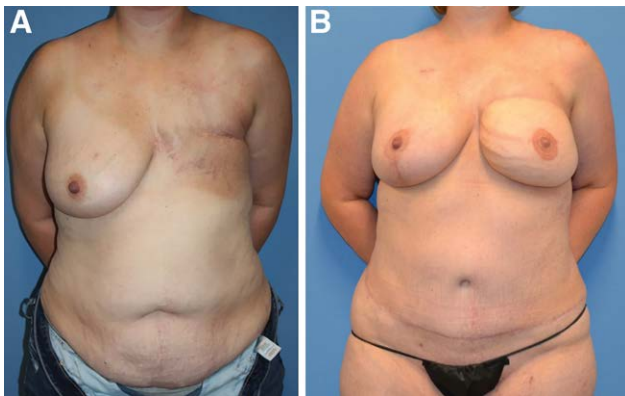
Approach ABR as a cosmetic operation, which may require a shift in mindset. A new breast cancer patient with breast ptosis and/or excess abdominal tissue can be viewed as an opportunity to do a so-called mommy makeover. With a DIEP flap, one can both improve breast shape and achieve an abdominoplasty appearance. Many patients view this as a silver lining to an emotionally and physically devastating life event.

#### Number 3: Thoughtful Flap Markings

Preoperatively, we mark the patient's breast footprint, inframammary fold (IMF), and midline. After marking the chest, we measure the chest width to determine flap markings on the abdomen, ensuring that the planned flap is at least large enough to cover the full chest width. Proper flap width is paramount to achieve an aesthetic result, particularly if lower pole chest skin will be resected. This ensures that sufficient skin will be present to resurface the chest. Furthermore, when staging a flap with a tissue expander or implant, a hand-in-glove fit during flap inset will create better flap projection and inset.



**Fig. 2.** Surgical result of DIEP flap reconstruction performed by the senior author. A, Preoperative photograph. The patient presented with a history of left breast ductal carcinoma in situ status post lumpectomy and radiation in 2003. B, Postreconstruction photograph of the same patient. The patient developed invasive lobular carcinoma in the left breast in 2021, and underwent a mastectomy and DIEP flap reconstruction, followed by one revision. No symmetry procedure was performed on the right breast.



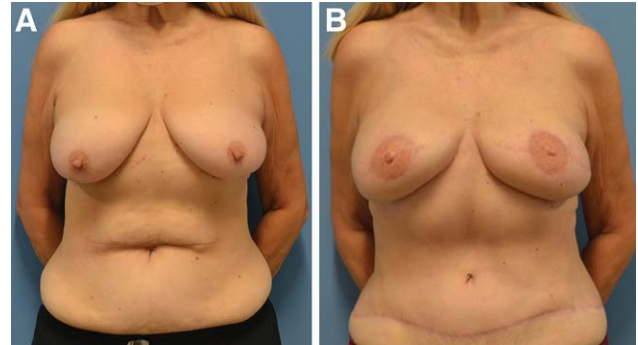
**Fig. 3.** Surgical result of DIEP flap reconstruction performed by the senior author. A, Preoperative photograph. The patient presented with a history of left breast cancer status post left total mastectomy and postmastectomy radiation therapy. B, Postreconstruction photograph of the same patient. The patient underwent left breast reconstruction with DIEP flap, followed by one revision, including a right breast reduction.

#### Number 4: Unilateral Considerations

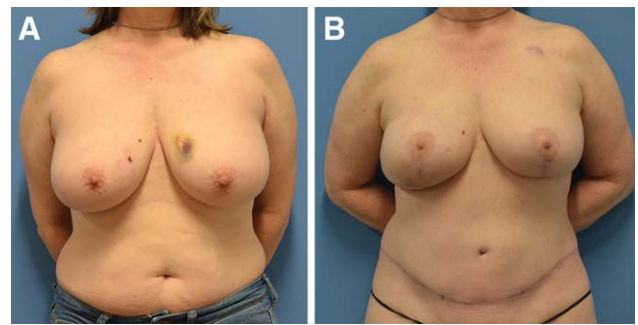
Cross the abdominal midline or use a bi-pedicled flap for additional volume for a unilateral reconstruction. We use SPY angiography to evaluate flap perfusion on selected perforators, often revealing that perfusion crosses the midline, allowing for a larger flap. A bi-pedicled flap or stacked flaps can also be performed for this purpose. The added skin and volume gained with this technique can create a more rounded and ptotic lower pole, and ultimately improve symmetry.

#### Number 5: Use the Fourth Rib

Use the fourth rib as the access point for the internal mammary recipient vessels. Using the third rib as this access point can leave a visible hollow in a thin patient or a patient with a long chest. The resulting deformity is challenging to conceal or fat graft. The fourth rib space is lower on the chest wall and is camouflaged by the flap,



**Fig. 4.** Surgical result of DIEP flap reconstruction performed by the senior author. A, Preoperative photograph. The patient presented with bilateral breast cancer. B, Postreconstruction photograph of the same patient. The patient underwent a bilateral skin-sparing mastectomy and immediate prepectoral tissue expander breast reconstruction. She then underwent staged bilateral DIEP flap breast reconstruction and one revision procedure, including nipple reconstruction, fat grafting, shaping of the lateral breast, and abdominal scar revision.



**Fig. 5.** Surgical result of DIEP flap reconstruction performed by the senior author. A, Preoperative photograph. The patient presented with multifocal right breast cancer and initially underwent a right lumpectomy and oncoplastic breast reduction. Unfortunately, a positive margin was noted at one lumpectomy site, and the patient elected to proceed with nipple-sparing mastectomy after a course of chemotherapy. B, Postreconstruction photograph of the same patient. The patient underwent a right-sided nipple-sparing mastectomy and immediate reconstruction with DIEP flap. The initial DIEP procedure was followed by one revision with fat grafting and abdominal scar revision.

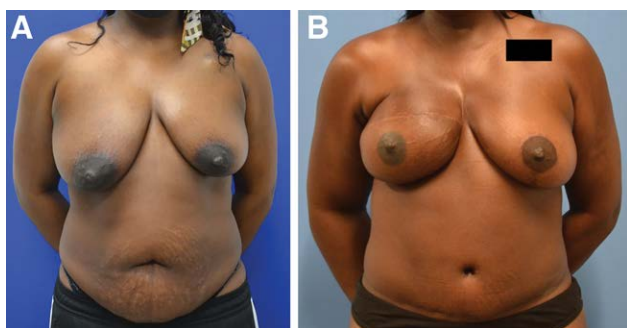
as the wider portion of the tissue sits on top of the defect. Additionally, suturing the Scarpa fascia of the flap to the chest wall at the medial aspect of the rib defect during inset ensures coverage and avoidance of a postoperative deformity. A rib-sparing technique is an excellent option for the experienced microsurgeon but may be challenging at academic centers with training programs because it provides a smaller area of access to the recipient vessels.

## INSET AND CLOSURE

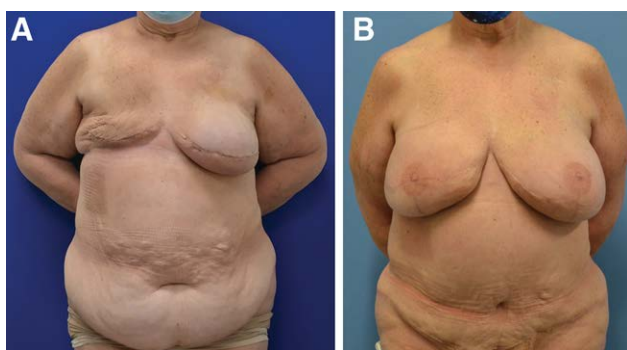
### Part I: Chest

#### Number 6: Be Deliberate

Take your time on the initial inset. DIEP flap surgery can be a lengthy and technically challenging operation,



**Fig. 6.** Surgical result of DIEP flap reconstruction performed by senior author. A, Preoperative photograph. The patient presented with right breast cancer. B, Post reconstruction photograph of the same patient. The patient initially proceeded with a right skin-sparing mastectomy and immediate direct-to-implant reconstruction, followed by postmastectomy radiation therapy. Subsequently, she underwent delayed right-sided DIEP flap reconstruction. Finally, she had one revision surgery, which included right nipple reconstruction, fat grafting, left breast reduction for symmetry, and abdominal scar revision.



**Fig. 7.** Surgical result of DIEP flap reconstruction performed by senior author. A, Preoperative photograph. The patient presented with a history of right breast cancer and had previously undergone a bilateral skin-sparing mastectomy, implant-based breast reconstruction, and postmastectomy radiation therapy to the right breast. Her right breast implant had been removed due to infection. The patient also had a history of sleeve gastrectomy and massive weight loss. B, Post reconstruction photograph of the same patient. The patient underwent bilateral breast reconstruction with DIEP flaps, and two subsequent revisions. The first revision included a Wise pattern tightening of the flap skin paddle to improve the breast shape.

and it requires extra stamina to spend time on the flap shaping and skin tailoring. This is the best chance to set yourself up for success with the final product. The reconstruction is significantly easier to revise when there is good symmetry after the initial flap surgery. Particularly when removing lower pole breast skin or resetting or recreating an IMF, spend extra time to measure, use a template, and sit the patient up to assess for symmetry. We acknowledge that some DIEP flap cases are more technically difficult than others, leading to additional mental fatigue. To prevent these challenges from creating an environment in which aesthetics are overlooked, we encourage approaching the inset in a systematic way in every case so

that deliberate flap inset is an expected part of the operation rather being thought of as a “bonus.”

#### **Number 7: Perform a Capsulectomy**

When staging a flap with a tissue expander or implant, we prefer to perform a capsulectomy to remove the acellular dermal matrix at the time of the DIEP flap chest dissection. After capsulectomy, the skin becomes more pliable and essentially recreates the original mastectomy defect. This allows for better re-draping of the mastectomy pocket around the flap and allows for easier shaping if skin resection is needed to match flap volume.

#### **Number 8: Excise the Radiated Breast Skin**

Excision of radiated breast skin can be nerve-wracking when first starting in practice because in the event of flap loss, a considerable open wound remains, necessitating a second flap. Despite this, there are significant benefits. Excision allows removal of hyperpigmented and damaged skin, improves ptosis and symmetry with the nonradiated side, and enhances the contour of the lower pole. At times, upper pole skin must also be removed to accommodate the flap and create an aesthetic breast shape. A helpful trick is to back cut the radiated skin toward the axilla until sufficient laxity is created to reshape the upper pole and fit the volume of the flap. Excision of radiated skin is demonstrated in [Figures 2 and 3](#).

#### **Number 9: Reset the IMF**

Often with a radiated tissue expander or implant, the IMF displaces superiorly and must be corrected for symmetry. The only chance to get this right when excising the radiated breast skin is at the time of the initial flap surgery. Mark the contralateral breast inframammary crease and draw a line to the radiated side to determine where the final IMF should be set.

#### **Number 10: IMF Cuff**

When resecting the lower pole mastectomy skin for flap inset, leave a 1-cm cuff of skin along the inframammary crease. This creates a more natural fold along the flap undersurface and avoids a “stuck on” appearance of the skin paddle. We prefer to mark the anticipated skin resection preoperatively, which ensures the new position of the IMF is symmetric and improves operative efficiency.

#### **Number 11: Skin Paddle Considerations**

Use a circular skin paddle when possible, to minimize scars and produce a more natural breast appearance. Before flap inset, tailor tack the breast envelope and sit the patient up to determine the desired nipple position. Mark the position using a 45-mm cookie cutter for the skin paddle. This allows for creation of a Hammond-style nipple reconstruction at the time of revision, which can ultimately be entirely concealed by a nipple areola tattoo.<sup>4</sup> This is demonstrated in [Figure 4](#). In an appropriately selected candidate, ABR combined with a nipple sparing mastectomy can provide an outstanding result. We

consider this combination to be the holy grail of breast reconstruction, as it essentially restores the breast to its original form. Use an IMF incision extended medially for sufficient access to the internal mammary vessels. In this case, use a small skin paddle along the IMF for monitoring, which can later be excised to completely bury the flap, as demonstrated in [Figure 5](#).

#### **Number 12: Incise the Dermis**

This was a technique that the author adopted in early practice and has been critical for creating a smooth and natural-looking breast.<sup>5</sup> During flap inset, incising the dermis around the skin island before skin closure prevents a “trap door” or indented appearance of the paddle. The smooth contour between the mastectomy and flap skin helps conceal the incisions and prevent distorting scar bands as much as possible. In our experience, this has not affected perfusion to the skin paddle.

### **Part II: Abdomen**

#### **Number 13: Make It an Abdominoplasty**

Plicate the abdomen when appropriate to tailor the waistline and create a desired abdominoplasty appearance. This adds little time to the operation and can be completed before starting microsurgery on the second side of a bilateral DIEP. This allows the abdominal closure and microsurgical anastomosis to occur simultaneously. We close the patient’s fascia in two layers, using a number 1 PDS in an interrupted fashion followed by a running layer. We most commonly perform a supraumbilical plication and extend infraumbilical if needed to create a smooth fascial contour without asymmetries or bulges.

#### **Number 14: Focus on the Umbilicus**

Pay attention to the umbilicus because your patient certainly will. An unnatural appearing umbilicus can become the focal point of the reconstruction even if you have triumphantly reconstructed the chest. Although many novel and unique techniques have been described, we prefer the inverted “U” technique with a wedge excised from the inferior aspect of the umbilicus to accommodate the abdominal skin flap.<sup>6</sup> If appropriate, the umbilicus can also be tacked to the fascia to create a more natural depression.

#### **Number 15: Be Strategic About Drain Scars**

Drain scars should be camouflaged when possible so that when the patient looks straight on in the mirror, scars are not visible. During the initial flap surgery, we prefer to place the abdominal drains just lateral to and in line with the abdominal scar. The drain scar is thus intrinsically excised with abdominal standing cutaneous deformities at the time of revision. We customarily place breast drains inferior to the IMF and lateral to the lateral border of the breast. These are minor adjustments to practice but can make a significant difference in a surgery with a high scar burden, particularly if the patient is prone to keloid or hypertrophic scars.

### **Revision Recommendations**

Plan for a revision surgery at a minimum of three months after the initial flap is performed. This secondary operation should be viewed as a chance to refine the primary result. In the case of unilateral reconstruction, this is when we perform a contralateral matching procedure, which may involve sitting the patient up multiple times to achieve a symmetric result. This is also when fat grafting is performed, and we use this as an opportunity to liposculpt the abdomen and improve the shape of the waistline. After liposuction, generous standing cutaneous deformities are excised from the abdominal scar. We remind patients that more than one revision may be necessary to achieve a symmetric result, particularly if a considerable amount of fat grafting is needed. Most of our patients have a single revision procedure after their initial reconstruction, with a smaller number of patients requiring two revisions.

#### **Number 16: Mind the Mons**

The mons can be a source of major patient dissatisfaction because it often seems more prominent and noticeable after excess lower abdominal tissue is excised. During the revision, we commonly perform liposuction of the mons and design a crescentic excision along the existing abdominal scar to correct any ptosis of this area.

#### **Number 17: Believe in Fat Grafting**

Simply put, it works. Fat grafting can be used to transform a reconstruction, but setting expectations is key. Fat grafting can be used to augment a flap or improve projection, in addition to sculpting the flap periphery; however, the surgeon and patient should be prepared that it may take multiple sessions to achieve the desired result. If more than one round of grafting is needed, we typically separate these sessions by 3–6 months.

#### **Number 18: Reconstruct the Nipple**

A breast without a nipple is just a shapely mound. The nipple creates a focal point and distracts from the surrounding scars. We prefer to create a nipple with either a C-V or Hammond flap, followed by a tattoo 6 weeks later.<sup>4,7</sup> A favorable nipple reconstruction result is noted in [Figure 6](#). Some patients prefer to skip the creation of a three-dimensional nipple to maintain a smooth surface and avoid wearing a brassiere for camouflage. In either case, we have found that the emotional response to adding a nipple to the reconstruction is profound and cannot be overstated. An increase in patient satisfaction, psychosocial well-being, and physical well-being after any type of nipple reconstruction has been reported in the literature, and this is supported by the outcomes experienced in the author’s practice.<sup>8</sup> Patients have described a sense of feeling more connected to their reconstruction after the nipple reconstruction and/or tattoo.

#### **Number 19: Address the Lateral Chest**

A common complaint after mastectomy and reconstruction is excess skin and subcutaneous tissue lateral to the breast, which, similarly to the mons, becomes more apparent after the native anatomy is altered. At the time

of the DIEP flap, we attempt to minimize this by tacking the flap medially and placing drains laterally to assist in closing the space. Additional concerns in this area may be addressed at the time of revision with liposuction and/or direct excision. This maneuver will round out the lateral breast and improve the contour of the chest. Reduction of this tissue also improves patient comfort in a brassiere and allows them to put their arms more easily by their sides, which can improve quality of life.

#### **Number 20: Mastopexy the Flap Skin**

This technique can be useful in the case of a large flap used to resurface the lower pole, but subsequently appears too long or ptotic after the tissues have settled. The simplest way to do this is to sit the patient up intraoperatively and tailor tack the redundant skin as a skin-only Wise pattern mastopexy until the desired projection and symmetry is achieved. This technique is demonstrated in [Figure 7](#).

### **CONCLUSIONS**

Autologous techniques in breast reconstruction have improved drastically in sophistication and reliability, and a shift in our paradigm is warranted to continue to improve our results and deliver the best care to our patients. As plastic surgeons, our standards for success should be the same for both our reconstructive and cosmetic patients. In this article, we describe the senior author's algorithm to optimize a DIEP flap's aesthetic result starting with the first case. Autologous reconstruction is surely an investment of time and energy, but you will thank yourself during the revision process if you set yourself up for success during the initial flap surgery. To summarize, this means maintaining your stamina at the end of the case and taking the time to be deliberate during the flap inset. Even so, every patient has unique anatomy that gives us an opportunity to exercise our artistic eye to create a reconstruction that suits them. It may take revisions to make the goal come to light. These steps are not meant to be

comprehensive or absolute; it is hoped that only pearls from a breast microsurgeon 8 years into practice will help others achieve superior cosmetic outcomes. We trust that these pearls will be a useful addition to the literature of refining ABR.

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### **DISCLOSURE**

*The authors have no financial interest to declare in relation to the content of this article.*

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