CHAPTER 53 AUGMENTATION MAMMAPLASTY: PRINCIPLES, TECHNIQUES, IMPLANT CHOICES, AND COMPLICATIONS

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INTRODUCTION

Breast implants have been FDA (Food and Drug Administration) regulated since the Medical Device Act of 1976. The FDA uses the total reoperation rate as a critical index when evaluating these devices, which has directed patients and surgeons to focus on the pivotal decisions that affect this rate. Reoperation rates at 3 years have consistently been in the 15% to 20% range, and the indications for reoperations have also been consistent over three decades. These statistics suggest that it is not the devices themselves that are responsible for the high reoperation rate. Rather, the problem is the way surgeons use them, including patient education, device selection, surgical planning, and the conduct of the operation. The FDA regulates the sale of implants by a manufacturer, but not the practice of medicine.

Focusing on the avoidance of complications is an ethical imperative, especially for an elective procedure. The same decisions and processes that reduce complications also predictably deliver superior aesthetic results. **The modern breast augmentation prioritizes avoiding complications, reducing reoperations, and minimizing iatrogenic damage to breast tissue.**

The success of an operation can only be improved when objective endpoints are defined before surgery. For oncologic surgeons and patients it may be local recurrence. For breast augmentation, the only valid quantifiable endpoint is the reoperation rate (when such criteria are defined preoperatively). What local recurrence is to cancer surgeons and patients, reoperation rate is to the aesthetic breast surgeons and patients.

THE PROCESS OF BREAST AUGMENTATION

Surgeons and patients tend to focus on the operation itself as the event that determines the surgical outcome, with preoperative discussion and postoperative management considered to be of secondary importance. This approach fails with breast augmentation where it has been demonstrated that reoperations can be reduced and patient satisfaction increased when a defined process is applied to breast augmentation.[1-3]

Each step of a breast augmentation is no better than the one that preceded it: planning is dependent on patient education; the operative procedure is dependent upon the operative plan; recovery is dependent on the surgical procedure; and final patient satisfaction is the cumulative result of all of these steps. Most important of all is how perceptions of success after surgery were defined at the initial steps of education. **Educating patients and having them sign off that their breasts will not match, that some ptosis can be normal, that the only truly natural breasts are non-augmented breasts, that implants can be felt, that no cup size can be promised, and that implant edges or the implant shell may become visible over time can actually increase satisfaction and reduce requests for reoperations. These issues must be made clear to patients as a part of informed consent.**

PHILOSOPHICAL APPROACHES TO BREAST AUGMENTATION

There are two schools of thought in breast augmentation: "Give the patient the size she requests" and "Give the patient the size that fits within her breast tissues." The former assumes that augmentation is a purely cosmetic procedure initiated by the patient. The surgeon's role is to safely deliver the result she requests, including issues such as the size and type of the implant, incision, and so on.

The latter emphasizes that augmentation is real surgery and that the plastic surgeon must make medically prudent decisions. Patients do not understand which implant will fit within their breast tissues. They do not necessarily understand the consequences of an excessively large implant on the shape of the breast in the short term, nor the adverse effects of them on breast tissues over time.

Neither philosophy should totally trump the other. Both must be considered concurrently and conflicts will arise. Patients may prefer one scar yet the surgeon realizes an objective benefit of another incision; a patient may want an implant of a certain size yet the surgeon may believe it is much too large or small for her breast envelope.

THE CAUSES OF REOPERATION

The only unequivocal endpoint assessing the quality of breast augmentation is the revision rate. Fortunately, the steps that reduce reoperations also create more beautiful breasts. The opposite of a malpositioned implant is an ideally situated implant; the opposite of a contracted capsule is a soft capsule, and so on.

The plastic surgeon's priority is to maximize preservation of tissue and prevent reoperation. This approach will simultaneously reduce her chances of facing the risks, costs, and

emotional distress of another operation and maximize the likelihood of an optimal aesthetic result.

CAPSULAR CONTRACTURE

Capsular contracture is and has always been a leading cause of revisions. As scar tissue thickens and tightens around the implant, the breast feels firmer, it looks becomes more spherical, the implant migrates superiorly, and the breast can be painful. Though patients may say, "my implants got hard," in fact, the implants are soft but constrained within a tightening envelope of their own tissue (see Figure 53.1).

The proximate cause of capsular contracture is inflammation, which in turn can be caused by silicone gel bleed, glove talc, blood, tissue trauma, and bacteria. Current evidence supports *Staphylococcus epidermidis* biofilm as a significant cause of capsular contracture.[4,5] Data include the association of biofilm with contracted capsules, the experimental induction of capsular contracture through inoculation of breast implants with *Staph epidermidis*, and reduction in capsular contracture from the use of antibiotic irrigation.

Breast augmentation is a "clean-contaminated" case because there are bacteria within the breast, the concentration of which is highest in the area of the periareolar (PA) incision. At least one study has shown a statistically significant increase in the percentage of capsular contracture using the PA approach.[6] (see Figure 53.2).

Patients should be educated before surgery that it is normal to feel the capsule around the implant (Baker grade II), that the capsules on the two sides never develop equally, and that revision should only be considered for a Baker grade III (firm and distorted) or Baker grade IV (painful). Surgery is not indicated for a Baker II capsule because there is little likelihood of creating and maintaining a Baker I (no discernable capsule).

While saline implants had an advantage in reducing capsular contracture over older generation silicone gel implants, the advantage no longer exists over today's silicone implants perhaps due to shells that reduce silicone diffusion or the use of a silicone filler with fewer impurities.[7,8] Meta-analyses demonstrate the benefit of implant texturing in the subglandular position, but no such advantage is seen in the submuscular position.

Malposition

Implant malposition creates some of the most severe deformities following breast augmentation (Figures 53.3–53.6). Breast appearance is determined by the amount and distribution of volume, which in turn is determined by the position of the breast implant.

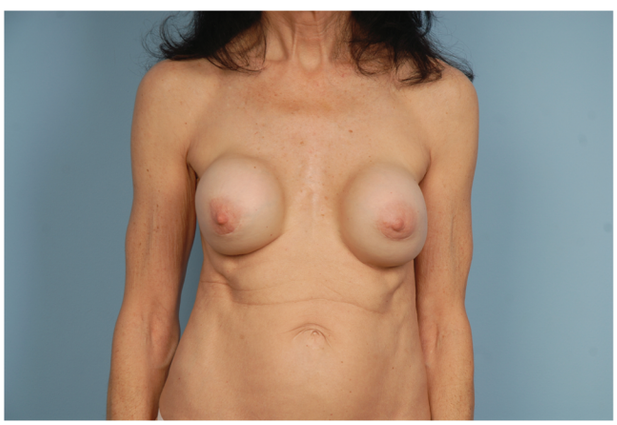

FIGURE 53.1. As scar tissue thickens and tightens around breast implants, the shape becomes more spherical, frequently rises upward, becomes firm, and often painful.

FIGURE 53.2. These cloudy droplets emanated from the lactiferous ducts during an inframammary augmentation. The ducts containing this fluid are divided during the periareolar approach and the implant surface becomes contaminated with the bacteria living within.

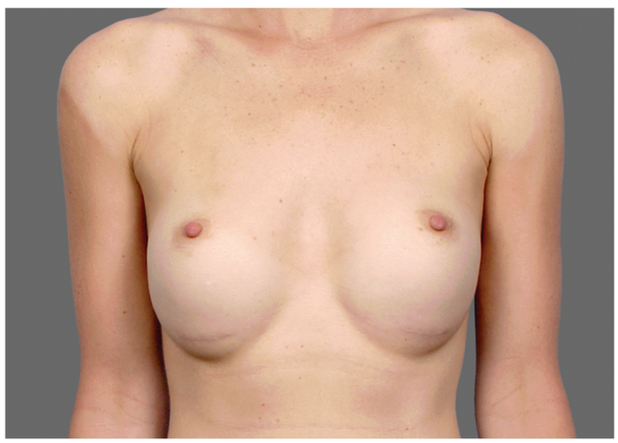

FIGURE 53.3. Inferior malposition results in up-pointing nipples and an empty upper pole. Note the position of the inframammary scars above the current inframammary folds.

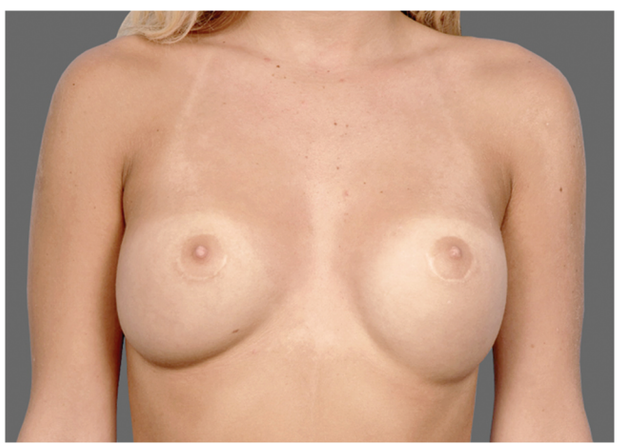

FIGURE 53.4. Lateral malposition results in an underfilled medial meridian of the breast and a widened intermammary distance.

FIGURE 53.5. While other malpositions are related to some combination of over-dissection, implant size, and irregularities in rib cage contours, superior malposition is the result of inadequate division of pectoralis along the inframammary fold or capsular contracture.

Over-dissection allows an implant to move out from its ideal position and incomplete dissection prevents an implant from settling in its ideal position. **The use of pressure wraps, circumferential bands, and special bras to push the implant against undivided tissues or to prevent an implant from migrating into an over-dissected space is ineffective. Accurate dissection is more effective than any external influence.**

Excessive lateral or inferior dissection allows implants to malposition in those directions; division of the pectoralis major muscle along the sternum risks symmastia and window-shading of the muscle which reduces coverage and leads to animation deformity; incomplete division of the pectoralis major muscle along the medial inframammary fold (IMF) predisposes to superior and lateral malposition; and failing to divide accessory pinnate origins of the pectoralis just lateral to its main trunk along the lateral sternal border may cause lateral malposition (or restrict ideal medial position of the implant and fill in that area).

Inferior and lateral over-dissection is most often inadvertent, medial over-dissection is often intentionally done to gain more cleavage. Not only does this reduce muscle coverage over the implant where tissue is thinnest, but also this method is least effective in the situations where medial fullness is most desirable: pectus carinatum, a wide intermammary distance, or extreme tightness of the skin against the sternum. Implant edge visibility and traction rippling caused by excessive medial dissection or division of medial pectoralis attachments along the sternum are largely uncorrectable deformities.

Even with a precise pocket, gradual migration from weight, pressure, and gravity can occur, particularly with chest wall deformities. For instance, a pectus excavatum will increase the likelihood of medial migration (symmastia), and a carinatum shape will predispose a patient to lateral malposition (Figures 53.7–53.9).

Whenever the musculocutaneous fibers that define the perimeter of the breast are divided, then it is the tenacity of the neighboring tissues that will either hold the implant in place or allow it to passively migrate. In order to create an ideally proportioned breast, the IMF may need to be lowered, but it must be done precisely; random and blunt lowering of the IMF is unpredictable and uncontrolled.

A surgeon should assess the strength of attachments between the soft tissues and chest wall at the inferior edge of the IMF incision. When these attachments are weak, the inferior cut edge of scarpa's fascia can be sewn to the muscle fascia. Some surgeons will routinely place such sutures with the inframammary incision.

FIGURE 53.7. Worm's eye view of patient with lateral implant malposition on the left and capsular contracture on the right.

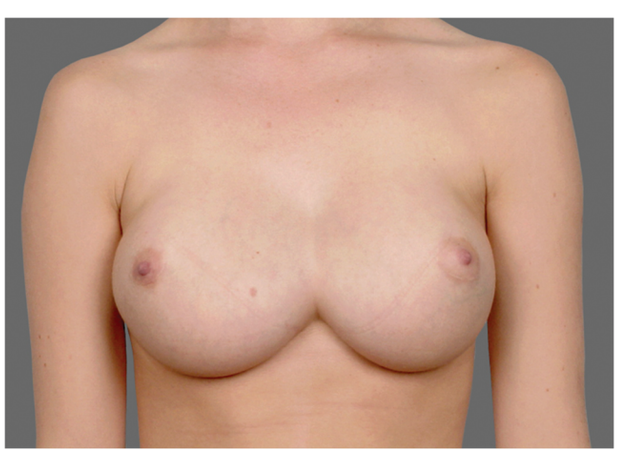

FIGURE 53.6. With medial malposition, the lateral breast is underfilled and the nipple points outward. Presternal skin can be raised off of the sternum.

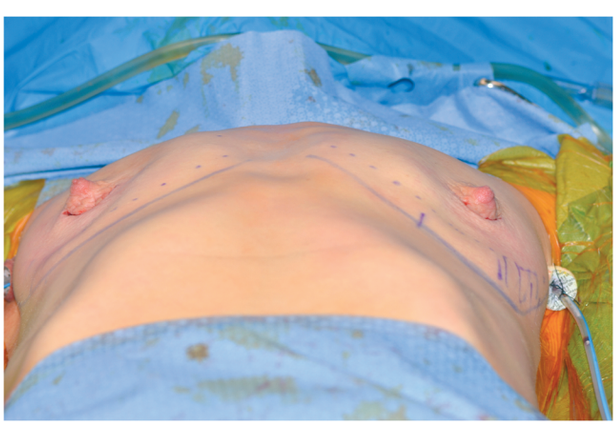

FIGURE 53.8. The pectus excavatum type of shape is now visible and it is obvious how her implants would tend to migrate laterally. Note also the depression of the ribs and parenchyma, particularly on the right, corresponding to the position of the contracted implant.

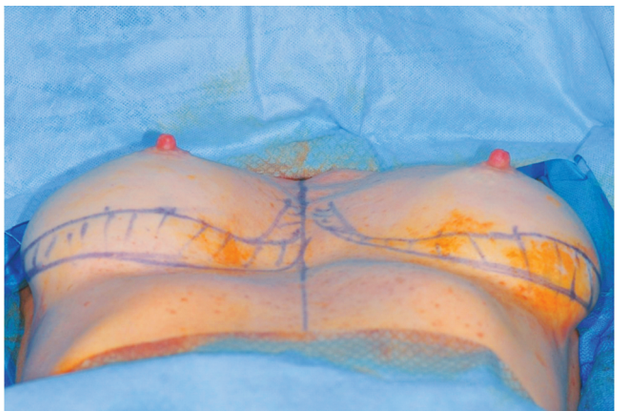

FIGURE 53.9. Medial rib cage depression (pectus excavatum) creates passive forces that can lead to symmastia. This situation tempts surgeons to divide enough pectoralis origins to fill the defect, but those fibers are critical to prevent a medial creep of the implant over time.

Size Exchange

Reoperation to change the size of an implant should be rare. Except for unusual changes in weight or lifestyle, reoperations for size exchange are usually the result of inadequate patient education and implant selection.

Determining implant size with bags of rice, water, and implants; filling a larger bra; prediction of a cup's size; or looking at photos puts the patient into a mind-set that implant size is totally her choice. This allows the patient to reconsider size in the future. When patients are educated to choose the implant that ideally fills their breasts based upon their breasts' dimensions, then future rationale for changing the size is limited. In addition, allowing a patient to expect to be a particular bra size is misleading because there is no standard for bra sizing.

When surgeons determine the implant size intraoperatively, they may find themselves being criticized by a patient dissatisfied with their size. This can be avoided when the implant size is agreed upon preoperatively. It is also apparent that sitting a patient up during surgery with air around her implants as swelling begins is not as accurate or predictive as preoperative objective tissue measurements (and prolongs operative time, increases tissue trauma, bleeding, and raises the possibility of contamination).

There is a misunderstanding that using measurements makes implant selection a surgeon's choice. Implant size is as much as patient's choice when she chooses to tell the surgeon to select the size that is best for her tissues as when she chooses to tell the surgeon a specific size. Optimal patient education and informed consent teaches patients the evidence-based benefits of published measuring systems, and the patient then chooses to use those systems to determine implant size. Patients are taught that breasts fill from the bottom up as if sand were being poured in from a funnel. There is an ideal volume to fill any particular breast. If the volume is excessive, the upper pole will be too full, and if the volume is insufficient, the upper pole will remain underfilled.

There is also an adage to "go larger, because patients always wished they were bigger." This is false. Many patients do request a second operation to receive smaller implants, and the patients who think they are too big often have soft tissue coverage and stretch problems as a result of those large implants. Those who feel too big often suffer from anguish or embarrassment, while those who contemplate being larger are not distraught, but perhaps just want "more of a good thing." But when the concept of "the right size" is taught to patients, then future requests for size exchange are nearly eliminated.

Ptosis

Ptosis recognized after breast augmentation either preceded the augmentation or was created by it. Preexisting ptosis may have been unrecognized or the patient may have declined having a mastopexy. Either way, augmented ptotic breasts are inevitably misshapen, and the weight and pressure of the implants can make the ptosis worse. Implants in thin, ptotic, and empty envelopes have a high tendency for palpable folds.

Breast augmentation is not a treatment for breast ptosis. An implant can fill an empty breast, but it does not raise nipples or shorten a long N:IMF (nipple to inframammary fold) distance. If a patient has a preoperative N:IMF of >9 cm, a mastopexy should be considered; when N:IMF > 10 it is required (Chapter 54).

Many patients with ptotic breasts do not want a mastopexy. In an effort to avoid the mastopexy, a very large implant might be used, perhaps making the breasts larger than what the patient desires. In some cases, the bottom of the implant remains at the IMF, and the breast tissue descends off the front of the implant mound, creating a down-pointing nipple and an upper bulge. In other cases, the implant falls to the bottom of the breast envelope and creates even more lower pole stretch, leading to more upper breast emptiness and an upturned nipple (see Figures 53.10–53.13). If a ptotic patient refuses mastopexy, then she should not have an augmentation. This is one of the most frequent avoidable errors in breast augmentation.

If a breast has a large envelope by dimensions and a small amount of existing parenchyma, (See "Size" on page 11), then it may take a large implant to fill the breast. Yet such skin may stretch from the pressure and weight of the large implant.

Post augmentation ptosis is invariably related to problematic patient tissues. The N:IMF distance on maximal stretch is an indication of the amount of skin between the nipple and the fold. When an implant is placed, the breast fills from the bottom up. If this distance is short, a given sized implant will create more upper bulge; if this distance is long, then a similarly sized implant will remain in the lower pole. Anterior pull skin stretch (APSS) is measured by pulling on the skin just medial to the areola and determining how far forward it will move with gentle pressure. When it is short it indicates that the skin envelope has little stretch to accommodate an implant, and when it is long it indicates that the skin will not lay tight against the implant. Parenchymal contribution to stretched envelope fill (PCSEF) is a measurement of how full a breast already is. If a given implant is put into a

FIGURE 53.10. Postpartum with a base width of 15 cm and an N:IMF of 11 cm. Her breasts are heavy and ptotic, but she did not want a mastopexy.

FIGURE 53.11. Three months after subglandular augmentation with a 550 cc implant.

breast that is already full, it will result in more upper fullness and definition of the implant, whereas an empty breast will have more room to accommodate the implant. When N:IMF > 9.5, APSS > 4, and PCSEF < 20%, the surgeon must recognize that the patient is in a problematic situation and is at risk for post augmentation ptosis that will require a revision surgery (see upcoming section and illustrations of these measurements).

Shell Failure

Retrieval studies demonstrate that over half of all shell failures are due to sharp instrument injury during implantation. Even a small scratch increases the chance of shell failure in stress cycle testing.

The implant should be kept in its thermoform packaging and touched only by the surgeon after changing into new gloves. Saline implants can be rolled and placed through smaller incisions than silicone. Since they are filled after insertion, all sizes of saline implants can be placed through an incision of the same length. Large, textured, or highly cohesive breast implants require longer incisions. There is no consistent rule about incision length. Incisions should be of adequate length to assure atraumatic insertion of the implant, with no abrasion to skin edges, damage to the implant shell, or "fracturing" of the fill in the case of some highly cohesive implants. Breast implants are most safely inserted through incisions with a minimal length of 4 to 4.5 cm, with longer incisions required for implants with a base width over 13 cm or a volume over 350 cc. While IMF incisions can be lengthened, staying within a small areola or axilla can make it challenging to use those incisions for gentle implant insertion.

FIGURE 53.12. At 18 months post augmentation the lower pole skin has stretched and the upper pole emptied. A breast augmentation is not a substitute for a mastopexy. Not only does she still need the mastopexy, but her tissue is more stretched now than before her surgery.

FIGURE 53.13. Top: two years after augmentation with subglandular implants in a patient who declined mastopexy. Note severe damage to the skin at periphery of implant and markings for a mastopexy.

Cautery and needles must never be in proximity to the implant. Pocket adjustment after implant placement must be made with retractors designed for implants. The surgeon should develop a system for closure that creates exposure and protects the implant from the needle.

Underfilled saline or silicone implants are more subject to collapse, shell folding, and possible failure along folds. Surgeons should use implants with a fill that optimizes shell folding, which is a consequence of both fill volume and fill cohesivity. Intraluminal betadine in saline implants can lead to shell delamination. Betadine irrigation into the pocket for both saline and silicone gel implants is against all manufacturers' Directions For Use. But given its value in reducing capsular contracture, this prohibition may be reviewed.

Rippling

Rippling in the décolletage inhibits the ability to wear low-cut clothing. Palpability reduces confidence and feels odd. **Rippling is probably the most distressing of all breast implant issues for patients. It is the least likely of all secondary augmentation deformities to be corrected (or even prevented) if the breast tissue, muscle, or skin is thin, loose, or damaged (Figures 53.14–53.17).**

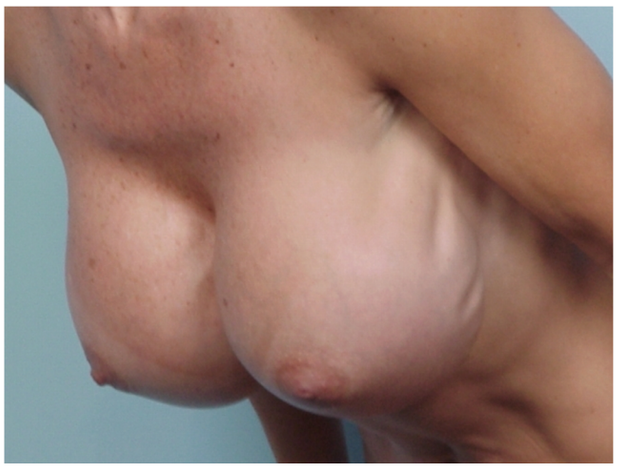

FIGURE 53.14. Implant underfill rippling can be visible with the patient upright, but is exacerbated bending forward. Adequate tissue coverage can conceal underfill rippling.

FIGURE 53.16. Severe underfill rippling in a nulliparous 26-year-old, only 4 years after augmentation with high-profile saline implants.

There are two types of rippling: implant underfill rippling and traction rippling.

Implant underfill rippling occurs when an implant shell is filled to a volume that does not prevent upper shell collapse with the patient upright, allowing shell folding as the filler descends to the dependent portion of the implant. Just as there is an ideal fill volume for the breast, there is an ideal fill volume for the shell. The manufacturer (or surgeon filling a saline implant) must balance the advantages of lower fill volume (less roundness and more softness) versus higher fill (less rippling). Increased cross-linking of silicone polymers increases cohesivity, which may reduce rippling by decreasing the amount of inferior descent of fill material within the shell.

Underfilled implant rippling can be camouflaged if tissue thickness over the implant is adequate, but the implant shell is nevertheless rippled. Even highly cohesive filler implants that are underfilled can cause rippling by pulling on thin overlying tissues.

Some surgeons opine that textured implants ripple more than smooth implants. Textured shells are only slightly thicker than smooth shells. Perhaps this stiffens the shell enough so that folds less readily dissipate upon light palpation.

Traction rippling occurs when an implant pulls on the capsule, which in turn pulls on the skin, much like a heavy object in a shirt pocket would create folds in the fabric.

Longstanding high-profile or contracted implants can create bowl-shaped deformation of the rib cage allowing the anterior surface of the implant to collapse and ripple.

Breasts most prone to visible rippling are those with inadequate tissue coverage (e.g., when pinch thickness of the skin and subcutaneous tissue superior to the breast parenchyma is less than 2 cm) or when pinch thickness at the IMF is less than 0.5 cm. Breasts with preexisting ptosis and those that are susceptible to postoperative ptosis (APSS > 4, NIMF > 9, and PCSEF < 20%) are also prone to rippling. These situations should be identified preoperatively. No type of breast implant can compensate for inadequate tissue coverage, and deformities that occur are largely uncorrectable. Surgeons should consider refusing to augment breasts when such tissue problems are significant. The role of tissue coverage in preventing rippling cannot be overstated. Therefore, the priority at primary augmentation is to maximize coverage and avoid tissue damage.

FIGURE 53.15. Same patient after using a higher cohesive implant. Underfill rippling is eliminated, but traction rippling creates lines of tension. Just as with underfill rippling, thicker tissue coverage and better skin elasticity reduces its appearance.

FIGURE 53.17. But the implant is just one component of her deformity; parenchymal atrophy, thinned skin, redundant skin, and a chest wall concavity will preclude her from ever having attractive breasts.

Asymmetry

Breast asymmetry is normal but if it is not documented preoperatively it may later be attributed to the surgery. Three-dimensional breast photo analysis has revealed that 72% of patients have significant nipple asymmetry and 94% have significant breast-mound asymmetry.[9] These should be demonstrated to the patient preoperatively and the patient should be made specifically aware that her breasts will not match.

Attempts to treat underlying asymmetries require trading one asymmetry for another. When trying to equalize breasts of different volumes, the larger breast would receive the smaller implant and the smaller breast would receive a larger implant. The smaller breast would appear more full and the larger breast less full. These choices can be appropriate but should be made only after careful consideration. **The use of different size implants to create more volume symmetry frequently creates a *shape mismatch* that is more noticeable than the size mismatch.**

The same planned N:IMF distance should be used on both sides, even if one nipple is higher. This assures breasts of more similar fill distribution, which is more aesthetically desirable than IMFs at the same height. Patients must be aware preoperatively that this is intentional and implants placed in this manner are not malpositioned.

Permanent Tissue Damage

Thin, weakened, stretched, and damaged tissues are responsible for the occurrence, severity, and difficulty in correction of many of the common reasons for reoperation. The same minor malposition or capsular contracture which would not be visible under thick tissue and tight skin can be quite visible under damaged tissue. Rippling is rarely an issue with good tissue coverage but becomes one when tissue is thinned. Finally, any problem that requires correction is more problematic to correct when tissues are thinner or weaker (Figures 53.18–53.27).

Both the surgical act of dissecting a pocket for a breast implant and the longstanding presence of an implant can cause atrophy of breast tissue. Prudent implant selection and exacting surgical technique can help preserve tissue integrity and minimize long-term parenchymal atrophy. Longstanding pressure against tissue causes remodeling: bras cause acromial grooving, orthodontics move teeth, and tissue expanders stretch and thin skin. A breast implant that stretches the breast envelope as much as would lactation can be anticipated to permanently stretch and alter breast tissue.

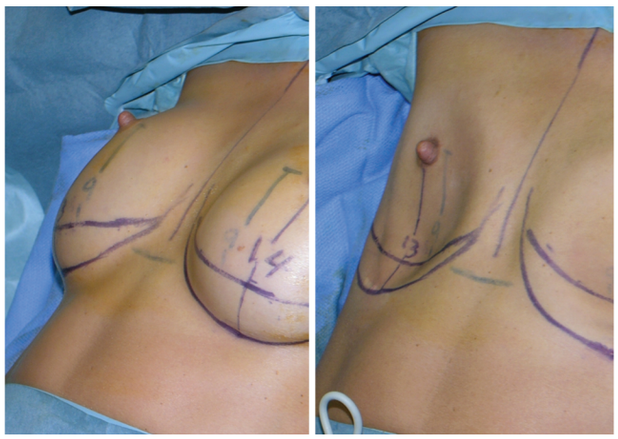

FIGURE 53.18. Two years after augmentation with high-profile implants. In addition to the inferior malposition, the pressure of the implants remodeled the rib cage. This reduces projection, makes an explantation option highly deforming, and increases the future likelihood of underfill rippling (see "Rippling" section) because this forces redundancy of the anterior surface of the implant.

FIGURE 53.19. Thinning of skin, parenchymal atrophy, and rib cage concavity are all present in this patient. There is always a question of the extent to which this was preexisting, an inevitability of time, or an effect of the implant. Notice how her tissue changes exactly correspond to the position of her implant.

Highly projecting implants place more pressure per area than a wider implant of the same volume. If width is held constant, highly projecting implants can be nearly twice the volume and weight, thereby placing substantially greater pressure on the rib cage as well as the soft tissue. This causes parenchymal atrophy, thinning of subcutaneous tissues, thinning and stretching of skin, loss of skin elasticity, rib cage deformation, and loss of sensation. In any case, if an implant of the proper volume is selected for a given breast, a high-profile implant would be excessively narrow for the breast and thereby create an imbalanced fill. If a high-profile implant is chosen of the proper base width for the breast, the volume is almost inevitably too great for the breast.

These tissue changes can result in rippling, skin stretch requiring mastopexy, and bizarre animation deformities. Such problems are often not correctable, and attempts to mask them with highly cohesive implants, an acellular dermal matrix, and fat injections all result in imperfect corrections which are expensive and pose their own risks and drawbacks. On the other hand, extremely damaged tissue can almost rule out explantation alone as an option because of the severe deformity that results (and explantation should always be considered in recalcitrant post-augmentation complications).

Preoperative decisions should make soft tissue coverage a priority and surgical technique should strive to protect it. When the pinch of tissue overlying the IMF is less than 5 mm, consideration should be given to not dividing the origins of the pectoralis major muscle along the medial IMF. If the muscle is going to be divided along the IMF, it should only be released to the junction of the IMF and the lateral sternal border, but not even one interspace above that. To do so permanently thins tissue along the sternum, which can cause uncorrectable traction rippling and risks symmastia. It also increases the degree of deformity when contracting the pectoralis major muscles. It also allows the muscle to migrate superiorly, further reducing critical tissue coverage.

Fibers between the pectoralis muscle and the overlying parenchyma should be preserved because they hold the superior cut edge of the divided pectoralis inferiorly, thereby maintaining lower pole muscle coverage after division along the IMF (Figure 53.28). This is one major disadvantage of the subglandular approach: it destroys these fibers forever and should a dual-plane pocket ever be necessary in the future, the absence of those fibers allows the muscle to slide superiorly, reduce coverage, and contribute to animation deformities.

Fig. 53.20.

Fig. 53.21.

Fig. 53.22.

Fig. 53.23.

FIGURE 53.20–27. **53.20** Twenty-year-old preoperation for breast augmentation. **53.21**. Intraoperation after placement of 380 cc high profile saline implants filled with 440 cc of saline. **53.22**. Severe deterioration of result at 2 years post operation. **53.23.** Intraoperative view after mastopexy 2 years after primary augmentation. **53.24.** One year after mastopexy with severe rippling. **53.25.** One year after mastopexy with 3 mm of coverage and damage to the skin at the junction of the implant and chest wall. **53.26.** Compare the thickness of her breast tissue following these large implants to what it was preoperatively, as shown in figure 53.20. **53.27.** At revision of mastopexy with implants removed, compare appearance of breast to her original preoperation: rib depression, skin stretch and texture changes, and loss of parenchyma. **53.28**. Green arrow points to serratus anterior muscle; red the origins of the pectoralis major muscle along the inframammary fold that will be divided; pale blue the origins of the pectoralis major muscle along the sternum; black the transition between inframammary fold and sternum above which no muscle is divided.

While there is a high level of success treating ptosis, malposition, and contracture, problems that result from damaged and thinned tissues are frustrating for patients and plastic surgeons; solutions are often elusive and results are too often disappointing.

Anatomy

Standard descriptions of anatomy of the chest are available in medical school textbooks, but important nuances of surgical anatomy are very relevant to breast augmentation surgery.

The thoracoacromial artery and vein and lateral pectoral nerve enter the pectoralis major muscle through a fat pad on the muscle's deep surface. Exposure of the bundle is not necessary and visualization of it suggests that dissection may be more superolateral than necessary. The medial pectoral nerve innervates the lateral oblique portion of the pectoralis major muscle after emerging either from within or lateral to the pectoralis minor muscle. Unlike division of the lateral pectoral nerve, division of the medial pectoral nerve does not produce symptomatic weakness.

Fig. 53.24.

Fig. 53.26.

Fig. 53.25.

Fig. 53.27.

FIGURE 53.20–27. (*Continued*)

Inferior to the medial pectoral nerve are lateral cutaneous nerves arising at each interspace, the fourth intercostal nerve providing primary sensation to the nipple. Larger implants require more lateral dissection and put more nerves in jeopardy.

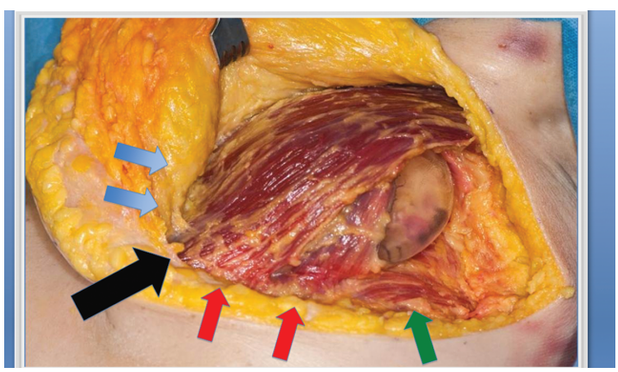

FIGURE 53.28.

Large perforating arteries and veins arise about 1.5 cm lateral to the midline. If the surgeon does not dissect more medially, then injury to these vessels is usually avoided. These same vessels usually enter the submammary plane about 5 mm more lateral than their entrance into the pectoralis. Dissection is too superomedial if the large caliber vein at the second intercostal space is visualized. It can be difficult to obtain hemostasis of these vessels, particularly on the chest wall side. There is also a risk of pneumothorax when trying to coagulate a vessel that has withdrawn into an intercostal muscle. So if these vessels are visualized and the decision is made to coagulate them, a stalk should be left along the chest wall.

Smaller but important perforating vessels must also be recognized inferomedial to the areola and another approximately midway from that vessel to the lateral sternal border. Several lateral intercostal vessels can be encountered along the lateral gutter of the pocket. When the lateral pocket appears tight after implant insertion, an atraumatic spatula-like retractor can be used to move the implant out of the way while the cautery is used to incrementally enlarge the pocket. Blunt finger dissection is less accurate and can result in lateral bruising and notable post surgical discomfort in that area.

In retropectoral or dual-plane augmentation, division of the pectoralis major origins along the medial IMF is necessary

to establish an optimal relationship between the width of the breast and the N:IMF distance, allowing optimal and proportional fill of the lower pole of the breast. Division should occur about 1 cm above the proposed IMF.

The medial pectoralis major origins along the lateral sternal border provide necessary coverage over the medial edges of the implant, help hold the superior cut edge of the pectoralis from sliding superiorly, and reduce the likelihood of medial malposition (symmastia). Division of any of the main body of pectoralis origins along the lateral sternal border also increases the severity of animation deformities and can produce uncorrectable deformities, including window shading of the pectoralis, visible implant edges, and traction rippling in the cleavage area (Figures 53.29–53.33).

Lateral to the main trunk of the sternal head of the pectoralis along the lateral sternal border, there are accessory tendinous pinnate origins of the pectoralis. Left intact, the more lateral of these will keep the implant too lateral, thereby reducing potential cleavage. So long as the main trunk of the pectoralis major muscle originating from the lateral sternum is clearly visible and distinct from these pinnate fibers, the pinnate fibers can be carefully divided.

The operative strategy should prioritize visualization of all structures, avoidance of contamination of the implant, and precise and gentle handling of all tissues.

SELECTING THE IMPLANT SHELL, FILL, AND SIZE

The fact that breast implant study data demonstrate consistent outcomes suggests that implant type is not the prime determinant of results. Manufacturer-sponsored premarket approval trials produce the best data because of independent monitoring of the studies by a contract research organization and the rigorous follow-up. Yet each of these only evaluates a single product line and no comparisons between different implants are performed. It is invalid to compare different outcome studies of the various implants because the cohorts are too different. So too are patient selection, surgical technique, participating doctors, and clinical endpoints.

Most plastic surgeons have opinions about implants based upon their own experience. It is unlikely that there will ever be a study in which different implants are compared one to another in a scientifically credible manner.

Implant Shell

Implant shells are made by sequentially dipping a solid mold of an implant form (a mandrel) into liquid silicone. One dip is made into a substance that reduces microscopic gel "bleed" for silicone gel-filled shells.

Texturing is an additional step, and it is done with a variety of ways. One method involves placing a thin and sticky sheet of silicone over the implant and pressing against it with a textured form. Another method involves placing salt or sugar crystals onto the surface of the implant after its last "dip," and then dissolving them away ("the salt-loss" method). There has been a question about the association of implants made by the salt-loss technique with anaplastic large cell lymphoma (ALCL) of the breast, though the number of cases is too small to make a valid conclusion.

The primary rationale for texturing implants is that it reduces capsular contracture. Studies have shown inconsistent results about whether texturing reduces contracture. A meta-analysis did show that texturing reduced capsular contracture,[10] but only in the subglandular and not in the submuscular position.[10] One type of texturing may be associated with late seromas.[11,12]

All "anatomically" shaped or "teardrop" implants are textured to create friction or allow tissue ingrowth and minimize the risk of rotational malposition. Some surgeons use textured implants when they are concerned that weak tissue or chest wall irregularities will predispose the patient to malposition. Others believe that textured implants improve the implant soft tissue dynamic by reducing the sliding of breast tissue relative to the implant.

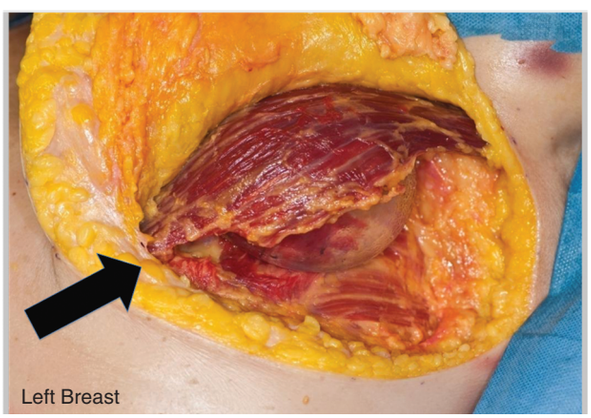

FIGURE 53.29. Release up to the black arrow places implant into a dual plane I position (see section on "Operative sequence"). Further vertical elevation movement of the muscle is the result of division between the fibers interconnecting the muscle and the gland see

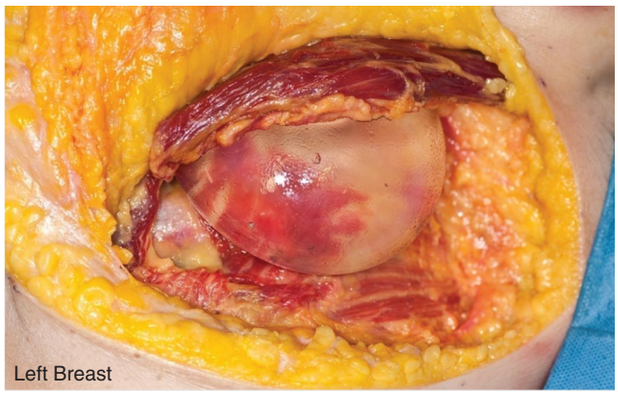

FIGURE 53.30. If muscle is divided along the sternum, the implant will lose coverage and the muscle can scar to the deep surface of the gland and create significant animation deformities.

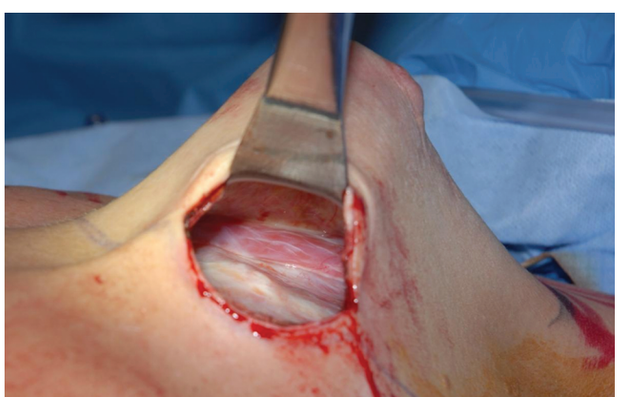

FIGURE 53.31. Muscle retracted far superiorly as a result of release along the sternum. The muscle no longer can provide coverage to the implant.

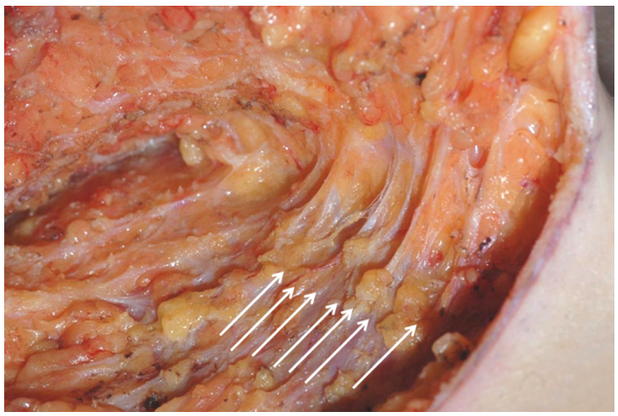

FIGURE 53.32. Intraoperative view during breast reduction demonstrates fibrous attachments between gland and superficial fascia of the pectoralis major muscle. Preservation of these in an augmentation is important to prevent the muscle from "window-shading" superiorly.

Some surgeons believe that textured implants are more prone to ripple even though the texturing adds negligible thickness to the shell.

Implant Fill Substance

Implant filler materials include saline, silicone, and highly cohesive silicone. Saline-filled implants were the only option available during the US silicone moratorium from 1992 to 2006. They can be inserted through a small incision and inflated once in the pocket. The surgeon balances adding more fluid in order to reduce the chance of fluid waves and ripples with filling it less so that the implant is softer and less round.

Studies are underway in the United State to study a baffled saline implant which aims to reduce the fluid wave and thereby ostensibly feel more like a silicone gel-filled implant.

Silicone gel has been the most venerable implant filer since breast implants were first used in 1962. It is generally believed to best mimic the feel of the human breast. Manufacturers can control the amount of cohesivity of the silicone, and it is now more gelatinous than it was in the 1970s. After the silicone gel moratorium ended in 1996, these implants rapidly again became the most popular implants in the United States and worldwide.

Breast implants filled with the most cohesive silicone gel are often referred to as highly cohesive, colloquially referred to by patients as "gummy bear." There is no standardized measurement or cutoff between a "regular" silicone gel and a "highly cohesive" silicone gel implant. The intention of the design of these implants is to maintain the distribution of fill within the implant, which should allow greater predictability and control over breast shape. This also tends to result in less shell collapse and folding, though these implants are not immune to that problem. While some uncontrolled data suggest they may have a lower rate of shell failure, high cohesive fill implants also experience shell failure. While highly cohesive implants maintain a more constant shape than do conventional silicone implants, they are not "form stable." An implant that is truly form stable would be too firm to be desirable.

A variety of "alternative fill" implants have been tested in an effort to either avoid silicone or to be radiolucent, such as hydrogel and soybean oil. None has yet achieved its objectives and none has received the FDA approval.

Implant Shape

The most commonly used implants have always been round implants. These implants are manufactured in various ratios of width to projection, so that the same volume implant can be narrower or wider. Higher profile implants will project more and be more spherical in shape than lower profile implants.

Shaped implants are sometimes referred to as anatomic or teardrop implants. The shell in these implants is shaped like a wedge, being less projecting at the top and more projecting at the bottom.

Implant shells cannot themselves maintain a filled implant in a particular shape, and for that reason shaped implants need to be made out of a more highly cohesive gel. Similarly, if a round implant were made out of a highly cohesive gel, it would stay round and not look like a breast. Therefore, shaped implants are typically highly cohesive, and highly cohesive implants are most often shaped.

Size

There are two approaches to selecting the implant size. One is to pick the implant size that will create the breast size the patient requests and potentially force the tissue into a certain

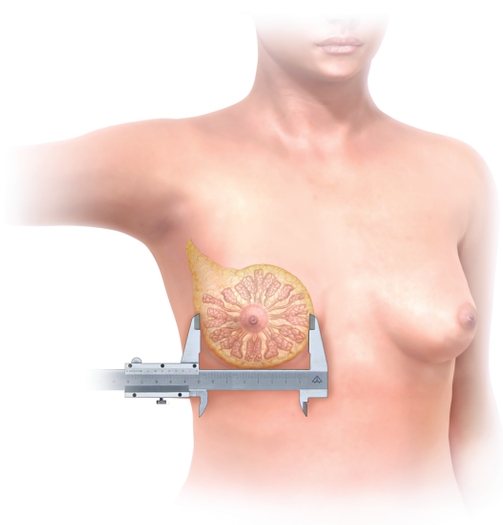

FIGURE 53.33. Base width is a linear measurement of the width of the patient's existing breast parenchyma. Even when the breast mound extends to the midline, the inner caliper should not go medial to an approximation of where the pectoralis origins on the lateral sternal border would be, since the muscle is never divided along the sternum and it would therefore be misleading to assume any greater width. (Courtesy of John B. Tebbetts MD).

size and shape. The other is to pick the implant size that fills but neither stretches nor distorts the breasts.

There are a variety of personal styles to size by the first approach: entertaining patient requests for a particular cup size; placing sizers of silicone, water bags, or rice bags in a bra she wishes to wear; selecting the size a friend received or was used on her favorite Internet photo; using three-dimensional computer simulations; surgeon empiric experience with sizing; or using intraoperative sizers to achieve a size that matches a photograph the patient provided or that the surgeon and their operating room staff believe looks most attractive.

None of these methods has been validated. All are highly subjective instead of being objective and scientific. They also leave the door open to the patient changing her mind about the size and requesting another operation to change her implants.

Some surgeons will start with the patient's volume request and will moderate their suggestion based upon their experience. Such methods are highly personal and do not give the young surgeon any practical guidance in implant selection.

A very important concept to recognize is that the breast shape will change as a function of implant size, for example, a small implant in a given breast will look less round and have less upper fill in a given breast than would a larger implant. Patients may make requests that are inherently contradictory, such as a breast that is flat in the upper pole but of such a large size that there would inevitably be a significantly convex upper pole.

The second approach is predicated on the hypothesis that each breast has an optimal fill volume. According to this method, quantitative measurements of the breast determine the implant size.

The BioDimensional™ System originated in a monograph published by Tebbetts for McGhan Medical and was popularized in the mid-1990s.[13] This system prioritized desired size over the size that optimally filled the breast. It was also a two-dimensional system, not considering the important third dimension of tissue stretch (though it did encourage many surgeons to start measuring breasts as a part of preoperative planning). And it did not take into account the effect of weight and pressure of the implant on adjacent tissues.

In 2001, the TEPID™ System for implant size determination was published by Tebbetts.[14] It was the first system that specified an implant size based upon breast measurements. It contained the crucial measurements of tissue thickness, stretch, and breast fill. The High Five™ System published by Tebbetts and Adams in 2005 took the implant sizing methodology of TEPID™ and incorporated it into a system for determining the five critical decisions in breast augmentation planning: (1) soft tissue coverage (pocket location); (2) implant size and weight (TEPID™); (3) implant type, shape, and dimensions; (4) IMF position (N:IMF); and (5) incision location[15] (Figures 53.34–53.37).

Thousands of patients sized with this methodology have been published in peer-reviewed journals; it is the most widely referenced and taught system of implant selection; it has been adopted by surgeons worldwide; and the objective nature of the system has allowed it to be easily adopted by surgeons of all levels of experience.

POCKET LOCATION

Options for pocket location are (1) total submuscular (subseratus and subpectoral), (2) partial retropectoral (behind the pectoralis with IMF origins intact), (3) subfascial (between the pectoralis muscle fascia and the pectoralis muscle), (4) submammary or subglandular (between the breast and the pectoralis fascia) and (5) dual plane (controlled amounts of pectoralis major muscle over some parts of the implant and breast over other parts of the implant (Table 53.1).

Total submuscular is more frequently a reconstructive technique, less commonly done for augmentation owing to a more painful and bloody dissection, a tendency for the device to rise superiorly, and difficulty in predictably creating a deep and well-formed IMF, particularly laterally. Subfascial has not been widely adopted due to an absence of satisfactorily controlled or long-term data. With only 0.2 to 1 mm more coverage than a classic submammary dissection, this procedure is a variation of the submammary pocket and does not qualify as a distinct pocket type.

Partial retropectoral and submammary have various trade-offs. The dual plane is the ideal compromise because it includes the benefits of each and minimizes the trade-offs of both. It allows the implant to be beneath the muscle where coverage is needed and against the gland where expansion is necessary, such as a constricted lower pole or a lax lower pole. Though this approach is colloquially referred to as "half over/half under," in reality the implant should never be over any part of the pectoralis major muscle. It is either behind pectoralis major muscle or it is behind gland. Some surgeons will dissect superficial to the pectoralis muscle and transect it in the direction of its fibers at the level they wish to have the muscle. But this permanently sacrifices any coverage benefits from the more inferior portion of pectoralis and once the muscle is divided the amount of coverage that remains is unpredictable.

The submammary and partial retropectoral pockets are specific entities. However, the dual plane is a continuous spectrum of options, occupying a continuous "gray-zone" between submammary and partial retropectoral. When the

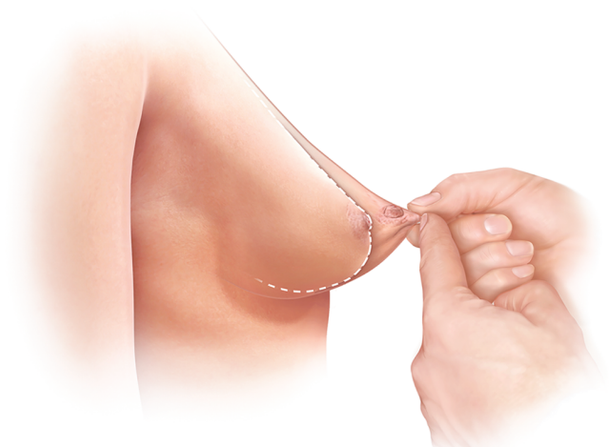

FIGURE 53.34. Anterior pull skin stretch (APSS) is commonly referred to as skin stretch. It is the measure of the distance the skin medially to the areola can be pulled forward, Augmentation Mammaplasty, 2009 (Courtesy of John B. Tebbetts MD).[13]

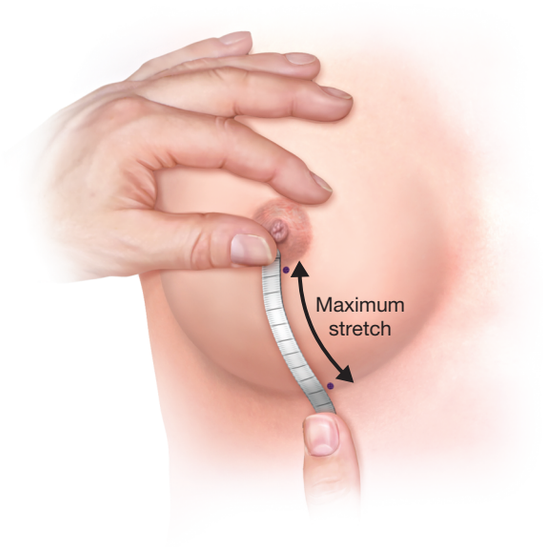

FIGURE 53.35. Nipple to inframammary fold distance is measured from the medial nipple on maximum stretch with the arms out to the sides on the operating table (Courtesy of John B. Tebbetts MD).

pectoralis major muscle is left intact at the IMF, the implant is partial retropectoral; if the muscle is divided along the IMF up to the intersection of the IMF and the lateral sternal border, the technique is termed as dual plane I. If the connections between the muscle and the overlying parenchyma are released so that the muscle slides up to about the lower border of the sternum, it is dual plane II; and if released to about the superior areolar border it is dual plane III.

The dual-plane operation starts with the creation of a partial retropectoral pocket (subpectoral pocket with no pectoralis major muscle division). As pectoralis major muscle origins are divided along the IMF, the muscle will reposition just slightly superiorly. If the muscle prevents expansion of the lower pole or if gland scoring is necessary, then the fibers between the muscle and the gland are incrementally transected. Very small

FIGURE 53.36. Parenchymal contribution to stretched envelope fill (PCSEF) is also referred to as just "fill." It is an estimate of the extent to which the potential space of the breast is full. It is the most imprecise of all of the measurements, but it only affects implant sizing in the extreme measurements, so exact measurement is unnecessary (Courtesy of John B. Tebbetts MD).

FIGURE 53.37. After the retropectoral pocket is made, the pectoralis is divided 1 cm above the proposed inframammary fold to create a dual plane I. The implant is variously submammary and subpectoral. There is no more release of pectoralis origins on a dual plane II or III than I.

amounts of this should be divided at a time; a mere several millimeters of dissection along the superficial surface of the muscle can yield a centimeter of vertical migration of the inferior cut border of the pectoralis. By disrupting attachments of the muscle to the overlying gland, the muscle can be gradually and incrementally raised, thereby reducing the proportion of subpectoral pocket and increasing the proportion of submammary pocket (Figures 53.38–53.42).

No matter the extent of the dual plane, the pectoralis major muscle is divided across the IMF, only to the point where the IMF joins the lateral sternum *and never superior to that point under any circumstances*. The inferior muscle origins are divided before the attachments between the muscle and the gland are transected; otherwise, control of the muscle position would be lost.

INCISION

Patients and surgeons often determine incision location by where they wish the scar to be. But **the scar is the least important distinction between the incisions**. Each incision exposes different anatomy; has differing levels of endogenous bacterial potentially seeding the implant, dissects through different tissues, and allows different amounts of visualization. A recent poll showed that about 62% of surgeons routinely use the inframammary incision, 25% the PA incision, and about 8% the transaxillary (TA) incision (Figures 53.42–53.44).

Though a dual-plane dissection can be performed from all incisions, the inframammary incision allows the greatest degree of control and precision. While this is certainly possible from the PA incision, the IMF approach facilitates preservation of all the attachments between the muscle and the overlying gland. Dissection from the PA incision down to the IMF or the proposed level of transection of the muscle often results in some degree of inadvertent disconnection of the muscle from the overlying gland, thereby resulting in unintentional superior elevation of the muscle.

Patients are frequently encountered whose implants were ostensibly retropectoral, yet in whom the muscle has retracted so far superiorly that the implant is no longer behind any muscle. The anatomy that influences muscle position is best visualized through the IMF incision and the young surgeon might delay considering the PA and TA incisions until after facility is attained with the IMF incision. A ptotic breast with a long N:IMF distance can also result in an implant that was initially placed in a retropectoral pocket sliding inferiorly and no longer being retropectoral.

TABLE 53.1

POCKET COMPARISONS

ISSUE	ADVANTAGE OF PARTIAL RETROPECTORAL	ADVANTAGE OF SUBGLANDULAR	DUAL-PLANE REMEDIES
Less pain		X	Best data to date
Better coverage	X		Large advantage vs SM; difference relative to PRP dependent upon release and up to determination of surgeon
Access to lower pole parenchyma		X	Yes
Expands constricted breasts		x	Yes
Fills ptotic breasts		x	Yes
Avoids muscle animation		x	Rarely clinically significant
Reduces tendency to "ride high"		x	Yes
Reduces tendency to "lateralize"		x	Yes
Faster recovery		x	Best data to date
Less capsular contracture	x		Best data to date
Better for mammograms	x		Appears to be
Reduce parenchymal atrophy	x		Best data to date
Reduces stretch deformities	x		Best data to date

Many surgeons release the muscle along the IMF and describe the procedure as "half over–half under," or even "partial retropectoral," which is exactly what is described as a dual plane type I. Muscle release can be performed via the PA incision but this may have the disadvantage of greater bacterial contamination and capsular contracture.[16]

A DP I, involving only the release of the pectoralis along the IMF, can be undertaken from the TA incision. Unlike a blunt and blind TA approach which risks uneven release of the muscle and imprecise level of the IMF, DP I TA should be performed with a bloodless, endoscopic technique. Creating a DP II or III, which would require retrograde dissection along the cut border of the pectoralis, remains beyond what current instrumentation will allow.

OPERATIVE SEQUENCE

For all incisions, the same operative principles apply: premeasured implant size; predetermined N:IMF distance; precise muscle release; preservation of the pectoralis along the lateral sternal border; preservation of the fibrous interface between parenchyma and pectoralis; all done with precise prospective hemostasis.

FIGURE 53.38. These fibers hold the muscle to the gland. They are released incrementally to allow the muscle to move superiorly and thereby place a greater amount of implant in the subglandular space.

FIGURE 53.39. This is taken seconds after the previous image; dividing just a few fibers causes significant superior muscle movement.

FIGURE 53.40. Restrictions are assessed and released when necessary, always prioritizing muscle preservation.

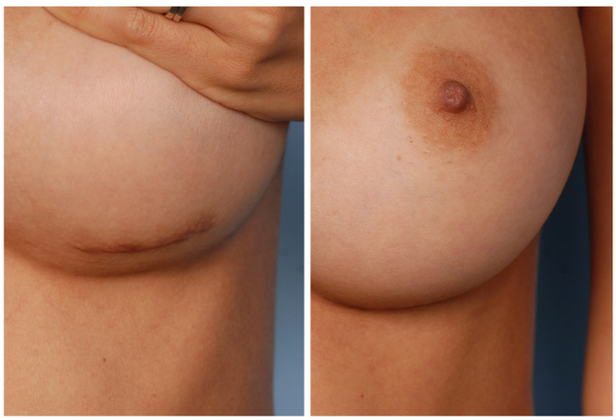

FIGURE 53.42. So long as the incision is placed in the new inframammary fold, a hyperpigmented and hypertrophic intramammary scar is only visible when the breast is pulled upward.

Since the scar must be within the new IMF, that location must be accurately determined before surgery. It is measured from the nipple with the skin on maximum stretch. In general, the standard of 7 cm for a base width of 11 cm, 8 cm for a base width of 12 cm, and 9 cm for a base width of 13 cm holds true. The High Five System contains a table that defines optimal N:IMF for each implant volume or base dimension. If the IMF is already greater than that distance, it does not need to be altered.

Some surgeons place an adhesive dressing over the nipples to reduce bacteria in the surgical field.

An incision is made at the proposed IMF. Dissection is carried straight down to the muscle fascia with the electrocautery, taking care to dissect slightly superiorly so as to preserve IMF fibers. It is all too easy to inadvertently dissect inferiorly and so this must be done with great care.

A double-ended or army–navy retractor is placed with the tip pointed toward the medial border of the areola. With no dissection made over the surface of the muscle, there will be little to hold the tissue on the blade of the retractor, so the ulnar fingers of the retractor hand are used to pull the tissue onto the blade. Because it is loose on its deep surface, the pectoralis will tent upward.

Only the pectoralis major will rise off of the ribs. Serratus, intercostal, and rectus muscles are adherent and will not rise. Lowering the cautery hand onto the upper abdomen so that the cautery is parallel to the chest minimizes the risks of inadvertent injury to the intercostal muscles. The tented pectoralis muscle is divided 1 cm above the desired new IMF and 1 cm off the chest wall origin to enter the subpectoral space.

The retractor blade is turned toward the sternum. The pectoralis is divided about 1 cm superior to the proposed IMF. Dissection stops at the lateral sternal border and never proceeds superiorly along the sternum.

The retractor is repositioned aiming to 12 o'clock, and the remaining areolar fibers are divided up to the superior extent of the pocket. It is very important at this stage of dissection to assure that dissection does not damage the thoracoacromial pedicle. This dissection should be completed before dissecting laterally.

The cautery then sweeps laterally raising the pectoralis major muscle from the pectoralis minor muscle. The plane between these muscles is more readily found when releasing from medial to lateral.

The dissection follows the lateral border of the pectoralis minor down to the inferolateral IMF. What seems like very small enlargements of the inferolateral pocket results in very large increases in the pocket when the implant is placed, so lateral dissection is limited and expected to be enlarged after implant placement if necessary.

A retractor is then directed superomedially and dissection proceeds from superior to inferior along the lateral sternal

FIGURE 53.41. While avoiding a scar on the breast, the TA incision produces the only scar visible outside of clothing.

FIGURE 53.43. The areola is the visual focus of attention and a periareolar scar can be very visible if not faint.

FIGURE 53.44. When there is focus on avoiding complications such as maximizing tissue coverage, avoiding malposition, contracture, and assuring adequate fill, the result is a beautiful and hopefully long-lasting result. This patient is shown 10 years after correction of capsular contracture.

border. This is often a very tight area and by leaving this as the final dissection there will thereby the best visualization of it. The main trunk or body of pectoralis fibers is always left attached to the sternum, but lateral, tendinous pinnate fibers between the pectoralis major and the ribs are divided. A large perforator at the second interspace is avoided, as well as perforators at each interspace located approximately 1.5 cm from the midline.

The pocket is irrigated with antibiotic solution and inspected for bleeding and accuracy.

The space thus created is dual plane I. To proceed to dual plane II or III, the attachments between the pectoralis muscle and the overlying parenchyma are incrementally divided, allowing the muscle to thereby move superiorly. While dual plane II denotes roughly the lower areolar border and dual plane III denotes a release to the superior areolar border, these are not distinct entities and merely serve as reference points. The surgeon should release only as much as is necessary to remove restrictions or to expose parenchyma if scoring is indicated.

Gloves are changed, and the implants are gently inserted. If the incision is too small to atraumatically place the implant, the incision is enlarged.

The patient is elevated to a sitting position for inspection of the breasts. Particular attention should be placed to the IMFs and the lateral breast pocket. If there are areas of flatness or under-dissection, the pocket should be enlarged only under direct visualization with the implant retracted by a retractor designated for breast implants. A very small amount of division can make a large increase in the pocket. A bulge in the upper breast can represent under-dissection in that area or 180° from it.

After repeating this process until the appearance is satisfactory, the incisions are closed with attention at all times directed to avoiding any contact between the needle and the implant as even small shell injury may increase the chance of a subsequent shell failure.

Skin closure should be meticulous and atraumatic to the skin edges to achieve an optimal scar result.

POSTOPERATIVE CARE

With precise visualization of the pocket, no special bras or straps are necessary to push the implant into position or prevent it from moving out of position. Tape or a steri-strip over the incision is the only dressing that is used. With bloodless dissection, no special bandages are necessary to create compression, and early motion is not just allowed, it is ordered. Patients move their arms over their head in the recovery room in a slow jumping jack type of motion. They may drive a car when they feel that they can safely make unrestricted movements, which is usually in 2 to 3 days. They are encouraged to perform all normal daily activities that do not involve strain or exertion, such as opening and closing car doors, putting on a seatbelt, lifting a baby, emptying a dishwasher, or making dinner. They may return to the gym after 3 weeks.

Most patients require only ibuprofen for analgesia once they leave the recovery room, and no increase in bleeding results from this practice.

COMPLICATIONS

Numerous factors contribute to complications and patient dissatisfaction in breast augmentation. Unrealistic goals, suboptimal implant selection, nonideal surgical plan, imprecise execution of surgery, healing problems, patient noncompliance with instructions, changes in body habitus, device inadequacies, and disorders of healing and patient biology create a diverse set of causes for complications and dissatisfaction.

Bleeding and infection are reported to occur at an incidence of 1% to 2%. Local complications are the most frequently encountered complications and their causes and avoidance were discussed in section "The Causes of Reoperation."

Breast implants do not increase the incidence of breast cancer. One large registry showed a lower incidence of breast cancer.[17-20] Breast implants are radiopaque and can interfere with mammograms. Additional "displacement" views are necessary in all of the standard mammogram views. Unless the implants are firm, the entire breast can be visualized. If not, then ultrasound or magnetic resonance imaging may be necessary to fully evaluate the breast. Proportionately, more breast cancers are detected by physical exam rather than by mammogram in women with breast implants when compared with women who do not have breast implants. This is perhaps a consequence of the platform of the implant behind the breast making it easier to feel the breast tissue.

In recent years, a new entity has been recognized that can arise within the capsular tissue. Brody's disease (after Garry Brody who described this entity) is a T-cell ALCL arising in the breast implant capsule. ALCL has been identified with both saline and silicone-filled implants. In the cases where the implant shell was known, most or all were textured. Of those, most or all were textured via a "lost salt" process, though these observations are anecdotal and not of sufficient numbers to draw conclusions.

Several theories have been proposed for the cause of ALCL: mechanically induced inflammation, chronic biofilm, reaction to shards of silicone, or causes yet undetermined. In countries with similar reporting there are widely different incidences of this disorder, and the spectrum of the disease has a wide range. Racial and ethnic background, gluten intolerance, and other factors are being investigated at this time.

Less than 100 worldwide cases are known. While T-cell lymphomas are very aggressive, only five of these patients presented with B-symptoms (fever, night sweats, and weight loss), four of whom died. The rest did not have metastatic disease and had benign clinical courses. Though primary T-cell breast lymphomas occur (about 90 per year in the United States), they involve breast tissue rather than capsule, and they have aggressive courses. Most of Brody's disease cases behave in a more benign manner, similar to cutaneous T-cell lymphoma. It would appear that most of these cases represent some form of benign lymphoid hyperplasia rather than a true lymphoma.

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