The Process of Breast Augmentation with Special Focus on Patient Education, Patient Selection and Implant Selection

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KEYWORDS

• Breast augmentation • Patient education • Tissue-based planning • Patient selection
• Implant selection

KEY POINTS

- Breast augmentation is not simply a surgical procedure but a process of 4 steps: (1) comprehensive patient education and informed consent, (2) tissue-based preoperative planning, (3) refined surgical technique with rapid recovery, and (4) detailed postoperative education.
- The nonsurgical steps, patient education and tissue-based planning, are essential to optimizing postoperative outcomes and reducing reoperation rates.
- The surgeon and the patient must assume a mutual responsibility that the implant has been selected based on breast dimensions and soft tissue limitations.
- Dedicated education, comprehensive patient/surgeon consultation, analytical documentation, and 3-dimensional imaging should be coupled with tissue-based planning to optimize results.

INTRODUCTION

The critical analysis of breast augmentation and its associated complications has driven our surgical practice to redefine our approach. We have scrutinized factors that influence patient outcomes and have acknowledged key characteristics that shape the successes of this common surgical procedure. This assessment has redirected breast augmentation from a surgical procedure into a surgical process.[1] Four key components have been outlined in this surgical approach:

1. Comprehensive patient education and informed consent
2. Tissue-based preoperative planning
3. Refined surgical technique with rapid recovery
4. Detailed postoperative education

These 4 steps to breast augmentation have been integrated into our surgical practice and have improved the patient experience, the reoperation rate, the postoperative outcome, and overall patient/surgeon satisfaction.[1] Even though these 4 steps can exist independently, the integration of all 4 steps in a patient's surgical experience work synergistically to optimize esthetic outcomes. Our refined process was developed in part from published concepts[2] and other plastic surgical practices have adopted this same protocol with

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equally positive conclusions; thus, this breast augmentation 4-step process is both transferable and reproducible. This article focuses on the first 2 steps of this comprehensive 4-step process of breast augmentation.

PATIENT EDUCATION AND INFORMED CONSENT

Team Approach to Education

The first step in the process of breast augmentation is the educational component; this step is the most critical aspect of the process and is frequently neglected by plastic surgeons. This approach solidifies a surgeon/patient partnership before surgical intervention, because this process requires not only the surgeon but also the entire staff of the clinical practice to be an integral participant in the subprocess of patient education. Thus, the surgical team has a responsibility to introduce the patient to the philosophy of the surgical practice. Instructional material and promotional multimedia may serve as an adjunct to the standards of the practice and influence patient education.

The patient and practice must create a partnership for implant selection and postoperative care. Together, they develop a mutual understanding that the implant will not only be selected based on patient preference, but also must incorporate breast dimensions and tissue characteristics. The patient must understand the limitations of her breast envelope and the implications of implant selection based on breast topography. Together, they will review patient images and physical attributes to delineate breast asymmetry and anatomic boundaries that impact implant selection. Furthermore, the practice patient educator and surgeon have a responsibility to discuss various implant options (eg, silicone vs saline, anatomic vs round, textured vs smooth) and how the selected implant is influenced by patient characteristics. This partnership in implant selection and postoperative care has been proven to enhance patient satisfaction and overall esthetic outcomes.[1] Recently, in our practice, 3-dimensional imaging has significantly revolutionized this partnership by allowing patients to visualize how an implant "fits their breasts," as well as potential differences between shaped and round implants.

The informed consent process is integrated into the educational process[3]; the risks should be discussed including, but not limited to, bleeding, infection, capsular contracture, implant malposition, rippling, and need for reoperation. A preoperative understanding of the complication profile will empower the patient to assume responsibility for the final decision. A new development that deserves attention during the patient consultation is the association of anaplastic large cell lymphoma (ALCL) and breast augmentation. Current evidence suggests the risk of developing ALCL is 0.1% to 0.3% per 100,000; in relative terms, a patient is approximately 2 times more likely to be struck by an asteroid than to develop ALCL.[4] Patients typically present with a delayed seroma after 1 year. The clinical course is indolent, and effective treatment includes removal of the implant and capsulectomy. Adjuvant therapy is rarely recommended. Fewer than 50 cases have been reported in the medical literature, but patients should be aware of this recent finding. Initial studies have suggested a correlation of ALCL with textured implants and/or certain bacteria, but more investigations need to be undertaken for any definitive conclusions.[4]

Determine Patient Knowledge/Patient Desires

The process of patient education and informed consent requires a multimodality approach. More often than not, patients have a misconstrued perception of breast augmentation based on previous experiences or multimedia influence. The surgeon and practice have a responsibility to dismantle any misconceived notions and educate patients on the relationship of breast tissue and implant selection. Our practice requires each patient to complete documents before an education consultation by our patient education specialist (**Fig. 1**). This consultation, in person or over the phone, typically lasts 45 to 60 minutes and discusses concepts, issues, and limitations related to the process of breast augmentation. This consultation is able to decontaminate any misinformation and convey the importance of tissue-based planning and implant selection. For example, the coordinator can dispel the inaccurate association of cup size and breast augmentation; most women wear inappropriate bras for their cup size and cup size is nonstandardized within the industry. At this time, the patient educator also can determine if the patient desires a "natural-look" or an "augmented-look" for her breast augmentation; this mentality will directly impact the rest of the consultation and implant selection. Again, 3-dimensional imaging can be an integral component of this discussion; patients can project various "looks" and can even overlay a bra or camisole on these simulations to optimize visualization. Thus, patients and surgeons can select the implant based on the breast envelope and implant characteristics rather than improper misconceptions.

The education coordinator initially performs the consultation with the patient, typically done in

Patient Concerns

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Additional Questions for Dr. Adams

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Have you had any type of Plastic Surgery before?
☐ **Are you happy with your results?**
☐ **My role in your care**
☐ **Our commitment to patient education**
☐ **What we'll talk about today**
☐ **Have you read the information we provided you?**
☐ **Clinical evaluation sheet medical history and patient preferences**
☐ **Brief history of augmentation**
☐ **Alternatives versus a single approach**
☐ **Do implants cause disease? The research and sources**
☐ **Breast implants and breast cancer**
☐ **Breast implants and mammography**
All implants interfere with mammograms
☐ **Breast implant technology**
☐ Constantly changing alternatives- current alternatives
☐ Limitations of implants- no implant is without tradeoffs
☐ **Summarizing the alternatives**
☐ Incision alternatives- inframammary, axillary, periareolar
☐ Implant pocket locations- retromammary, retropectoral, dual plane, totally submuscular
☐ Current implant choices (all saline)- Smooth round, textured round, textured shaped or anatomic- types and manufacturers
☐ Fitting the procedure and implant to your tissues to minimize long-term risks and compromises
☐ **Determining the best size**
☐ If you could just pick a size, what would it be?
☐ Which is more important, size or problems long-term?
☐ Common misconceptions
☐ How implant size affects your tissues- now and later
☐ Bra cup sizing-we can't guarantee cup size
☐ Balancing your breast with your figure
☐ Measuring your breast, understanding your tissues
☐ Concentrating on shape, fill, dimensions
☐ Photos and planning the operation
☐ **The operation- what's it like**
☐ Day surgery routine
☐ The facility and facility personnel
☐ Anesthesia
Safety of anesthesia, misconceptions, risks
Local versus general anesthesia
Our anesthesia personnel
☐ **During surgery**
☐ What will occur, expected time frame
☐ **After surgery**
☐ Waking in recovery, then to stepdown with caregiver
☐ **Detailed instructions will be given to you**
Tells you and your caregiver what to expect and do
What we do simplifies your instructions
☐ **Recovery and activity**
☐ Importance of resuming normal activity
☐ What we do and what we need you to do
☐ No bandages, bras, straps, drains or special

☐ **Risks of augmentation**
☐ This is a totally elective operation with risks and uncontrollable factors
☐ Bleeding
☐ Infection
☐ Sensation compromise
☐ Capsular contracture
☐ Unsatisfactory aesthetic results or scarring
☐ Interference with cancer detection
☐ Complications may require additional surgery, longer recovery, additional costs
☐ Reviewed risks on consent forms & documents
☐ **Capsular contracture and breast firmness**
☐ What is it?
☐ How a capsule forms
☐ Controlling the capsule
☐ How often does it occur?
☐ Correcting the hard breast
☐ **Factors that the surgeon cannot predict or control**
☐ Capsular contracture
☐ Different degrees, if severe, requires reoperation
☐ Surgeon alone makes final decisions re: reoperation
☐ All costs are patient's responsibility, no insurance
☐ Tissue stretch problems- increase with implant size
o Stretch allowing implant shift downward or outward
☐ Stretch allowing implant rotation
☐ Traction rippling
☐ Your request for a different size implant after surgery
☐ **All costs for any surgery relating to factors the surgeon cannot predict or control are the patient's responsibility (surgeon fees, facility fees, anesthesia, lab, time off work)- includes capsular contracture, stretch deformities, implant size changes.**
☐ **Importance of communicating with us**
We want to do what you want
You must be honest with us at all times
The surgeon cannot read your mind
☐ **What you can expect from Dr. Adams**
Type of care. Written materials. Photos. The operation. Your care.
☐ **Dr. Adams' Qualifications**
Surgical training, board certification, professional affiliations, scientific publications, other.
☐ **Patient has read all information material provided (Yes/No) _____Pt. Initial.**
☐ **Discussed any significant other's involvement, gave patient copy of Will There Be Anyone Else Involved.**
☐ **Written information provided patient was discussed in detail with patient, answered patient's questions to patient's satisfaction.**
☐ **All informed consent documents discussed in detail with patient, answered patient's questions.**

_____Pt. Initial _____Pt. Educator Initial

Fig. 1. Our breast augmentation patient educator consultation checklist.

person or on the phone, as a separate consult that precedes the surgeon consultation. During the surgeon consultation, the surgeon can objectively review the breast dimensions, confirm the patient's goals, and formulate a surgical plan. In the patient-surgeon interaction, asymmetries are identified and directly addressed using an image analysis sheet (**Fig. 2**). Patients must have realistic expectations on intermammary distance, cleavage, implant characteristics, and implant palpability. By dispelling any misconceived notions, the surgeon and the patient can synergistically select the appropriate implant based on individualized tissue. Additionally, with joint preoperative

Patient: «Person_First_Name» «Person_Last_Name»

Date: _____

❒ L/R breast larger- breasts will **never match!!!**
❒ L/R nipple-areola higher on chest- will not be totally corrected
❒ L/R fold beneath breast higher on chest- will not be totally corrected
❒ Nipple position on the breast mounds is different on the two sides and cannot be totally corrected
❒ Gap between breasts can only be narrowed somewhat- a gap of at least _____cm. will likely remain
❒ Chest wall asymmetries exist that cannot be corrected and will affect breast shape
❒ The position of the entire breast on the chest wall will not change. If one fold beneath the breast is lower than the other, it will also be lower after your augmentation.
❒ The basic shape and configuration of the breasts will be similar to their current appearance and not change drastically, but will be larger
❒ Thinner tissue inferior and lateral can result in implant palpability

❒ Other: _____

❒ Other: _____

❒ Other: _____

❒ Other: _____

Patient Please Initial below to document your understanding and acceptance of the above.

_____ Dr. Adams has reviewed my patient images with me in detail. I have seen, understand, and accept each of the factors listed above that will not change or may be only partially improved following my augmentation. I totally understand and accept that my breasts or components of my breasts will never match on the two sides, and that perfection is not an option, only improvement in the size of my breasts.

Fig. 2. Our breast augmentation patient image analysis checklist.

planning and implant selection, patients will accept their postoperative results and rarely present for size-exchange procedures. Approximately 20% of patients in our practice may question their size postoperatively, but they are reminded of the preoperative planning with the associated photographs, which usually reaffirms implant size selection and patient satisfaction.[5]

IMPLANT CHARACTERISTICS/SURGICAL APPROACH

Shaped Versus Round

Breast implants can be either round or anatomically shaped. Of note, round implants are used in 95% of primary breast augmentations in the United States.[4] Within both subsets, there are a wide variety of widths, heights, and projections. Anatomic implants may even have more variability because of their naturally asymmetric shape. Plastic surgeons should vary implant selection to optimally "best fit" a breast envelope. However, surgeons may use only one implant style because of their training or comfort. Our practice believes some situations dictate a certain implant based on patient preference or breast anatomy.[5] Superseding all of these sentiments is the concept that the best patient for an anatomic implant is the patient who "wants it." Indications for both round

implants and anatomic implants are outlined as follows:

Round implants
1. Desired augmented look
2. Good soft tissue coverage/good basic breast shape
3. Revision surgery (change of implants, capsular contraction, implant rupture, rotation)
4. Recurrent implant rotation/concerned about rotation

Anatomic implants
1. Desiring a natural look with minimal or no breast tissue
2. Shapeless breast or breast with poor soft tissue coverage
3. Constricted lower pole or tuberous breast deformity
4. Simple or complex asymmetry
5. Ptosis or lower pole laxity (poor tissue may limit placement)

Smooth Versus Textured

Textured devices were initially created to mimic the external shell of polyurethane implants; these implants had a coarse porous exterior with very low capsular contracture rates.[6] Recent Level 1 trials have not demonstrated lower capsular contracture rates in textured implants in the subpectoral pocket; however, some clinical studies have suggested reduced capsular contracture rates using textured implants in the subglandular space.[6] Most likely, the low capsular contracture rates seen in polyurethane implants were related to a biochemical reaction and not the texturing of the device.[6] Of note, smooth implants are currently used in approximately 90% of patients receiving primary breast augmentation in the United States.[4] Our practice uses texturing only for anatomic implants.

Saline Versus Silicone

A patient's anatomy or personal preference may dictate saline or silicone filler; however, the fillers have distinct properties that should be discussed during the initial patient consultation. Advantages of saline implants include smaller incisions from a remote location, less required monitoring, and decreased costs. Disadvantages of saline implants include increased risk of wrinkling and palpability, less natural touch, more tissue effects over time, and spontaneous deflation. Advantages of silicone implants include less wrinkling and palpability, no risk of sudden deflation, and a more natural touch. Disadvantages of silicone implants include MRI monitoring, "silent rupture," increased costs, and a slightly longer incision. The implant choice in our practice is typically selected by patient preferences and breast anatomy.

Pocket Plane

Implants can be placed in the subpectoral, subglandular, subfascial, or dual-plane pocket. Advantages of the subpectoral position include improved upper pole contour, decreased incidence of capsular contracture, and better breast tissue visualization during mammography. Disadvantages include increased discomfort from submuscular dissection and potential rare occurrence of implant distortion by pectoralis contraction, although a proper dual-plane pocket negates all these disadvantages.

Subglandular placement of implants may be appealing because of misconceptions of decreased postoperative pain and ease of dissection; however, the disadvantages of subglandular positioning typically outweigh these positives, including poor superior pole esthetics and rippling, increased capsular contracture, and difficult mammography imaging.

Subfascial placement has been suggested by various investigators to offer the same protection as submuscular placement against capsular contracture with less postoperative pain; however, the pectoralis fascia layer is typically thin and requires a tedious dissection. Our practice has found minimal clinical indications for subfascial placement.

The dual-plane technique places the implant partially subglandular and submuscularly. Incremental and planned release of the submuscular fibers at the muscle-gland interface allows the surgeon to vary the muscle coverage of the implant leading to optimal implant–breast parenchyma dynamics.[7,8] Dual-plane position eliminates virtually all of the disadvantages of the traditional submuscular approach while maintaining the benefits of muscle coverage.[9] All implants placed in our practice are dual-plane with the exception of true body builders.

Incision Selection

Popular available incisions for breast augmentations include inframammary, peri-areolar, axillary, and peri-umbilical. Certain patient anatomy or implant choice may suggest an incisional approach; however, often the chosen incision is patient/surgeon preference. The inframammary approach continues to be the most popular access for breast augmentation, as it provides the best control. This approach offers visualization of

the subpectoral plane without violating the breast parenchyma. Indications for this incision include small areolar diameter, large form-stabled implants, glandular ptosis, and large-volume implants (>400 mL). The real challenge/key point of the inframammary approach is placement of the incision at the postoperative inframammary crease (the new inframammary fold [IMF] incision). If the placement is miscalculated and the inframammary crease is repositioned intraoperatively, the scar will not be in the optimal location and poor quality. Furthermore, a malpositioned IMF would alter the postoperative nipple-to-IMF distance and inherently distort overall breast esthetics. The inframammary approach has evolved as the preferred surgical access of our practice; this incision is predictable and reproducible when implant-specific tissue-based principles are followed and provides the most control. We place the calculated postoperative fold starting 1 cm medial to the areola, then extending a length laterally that will accommodate the size of the implant (typically 4–5 cm).

The peri-areolar incision hemi-circumnavigates the areola, usually hidden with an inconspicuous scar at the pigment of the areola and native breast skin; however, recent studies have shown an increase in bacterial load, and subsequently, increased capsular contracture with this incision.[10–12] Thus, we typically avoid this access choice in our practice.

Axillary access for breast augmentation is an intriguing approach because many surgeons market this access as scarless. Indications for axillary breast augmentation include small areola diameter and small silicone implants or saline implants. The patient also must have appropriate breast anatomy: adequate breast tissue, normal body habitus, and ideal shape. This incisional approach can be either blunt dissection or endoscopic assisted. Of note, blunt dissection is technically easier but requires experience, and the endoscopic approach necessitates complex technical equipment. Both axillary techniques have an increased risk of superior implant malposition because of the poor visualization of the inframammary crease. Furthermore, this procedure may be more painful, and revisional surgery normally requires an additional remote incision. Surgeons must avoid the axillary fat during this dissection to prevent lymphatic trauma and associated sequelae. Some science has demonstrated a higher capsular contracture rate with the trans-axillary incision as well,[4,5] although some proponents of the incision have documented similar rates.[13]

The peri-umbilical approach (trans-umbilical breast augmentation) has been discussed in the literature for saline devices. This approach requires an extensive blunt dissection in the subscarpal plane to access the subpectoral pocket and is typically reserved only for surgeon preference.[4] The approach has many drawbacks and does not execute breast augmentation at the highest level.

During the education and surgeon consult, patients who desire various incisions are presented these data points, and in the past 5 years, all have requested the new IMF incision.

Limitations Patients Should Understand

There are certain patient anatomic variations that may influence implant selection and deserve mentioning. For example, plastic surgeons and patients must recognize chest wall morphologies, which can affect the orientation of the breasts, and thus, the positioning of the implants. A round chest wall lateralizes the breasts; and alternatively, a rectangular chest wall medializes the breasts. Patients are counseled that the position and morphology of the breast on the chest wall cannot be altered with breast augmentation. Furthermore, hemithorax asymmetry or scoliosis may require different implants despite equivalent breast volumes to recreate symmetric chest topographies.[4]

A separate unique patient population is the postpartum breast augmentations. After pregnancy, the breast tissue atrophies with poor skin elasticity. This skin/soft tissue transformation may accentuate implant visualization and migration. Silicone implants with conservative volumes may decrease postoperative rippling and bottoming out. Furthermore, these patients may have nipple hypertrophy and nipple/breast ptosis. Concurrent nipple correction or mastopexy may augment the overall cosmesis.[4]

PREOPERATIVE ASSESSMENT/CONSULT KEY POINTS

Patient History

Psychosocial elements may impact the surgical course; for example, the patient and surgeon must discuss the motivations behind surgery. Does the patient hope to achieve a “natural” or “obvious” breast augmentation? We generally assimilate all of this information in the education portion of the consult.

Physical Examination/Measurements Key Points

Basic measurements are needed to assess tissue coverage before implant selection, including breast base width, skin stretch, and nipple-to-IMF distance on stretch. The combination of these

breast measurements and breast type are essential for implant-specific tissue-based planning. In breast augmentation surgery, neither the artist (no measurements) nor the engineer (only measurements) is ideal, but our group has proven that scientific measurements create surgical boundaries for an artist to optimally function.[14]

Breast base width

The breast base width (BBW) is the actual width of the pocket in which the implant will be placed. The BBW is inherently smaller than the actual width of the breast. The BBW is the linear measurement across the widest transverse portion of breast (usually at the nipple) from the medial border of the breast mound to the lateral border of the breast mound (**Fig. 3**).

Skin stretch

The skin stretch (SS) is measured by grasping the skin of the medial areola and pulling the breast maximally anteriorly. The SS distance correlates to the anterior-posterior excursion measured with a caliper (**Fig. 4**).

Nipple-inframammary fold on stretch

The nipple-inframammary (N:IMF) fold measurement is obtained by using flexible tape from the midpoint of the nipple under maximal stretch to the IMF (**Fig. 5**).

Breast type (implant-specific planning)

The breast type has evolved from the High-5 System to measure the contribution of the patient's existing parenchyma for implant-specific tissue-based planning. We have determined 5 breast types and these are subdivided based on envelope quality and N:IMF on stretch (**Fig. 6**).

Breast Type I (very tight) SS <1.5 cm
Breast Type II (tight) SS 1.5–2 cm
Breast Type III (average) SS 2–3 cm
Breast Type IV (loose) SS 3–4 cm with N:IMF <9 cm
Breast Type V (very loose) SS 3–4 cm with N:IMF >9 cm

Fig. 7 represents the integration of BBW, SS, N:IMF, and breast type to create a blueprint for implant selection for implant-specific tissue-based planning.

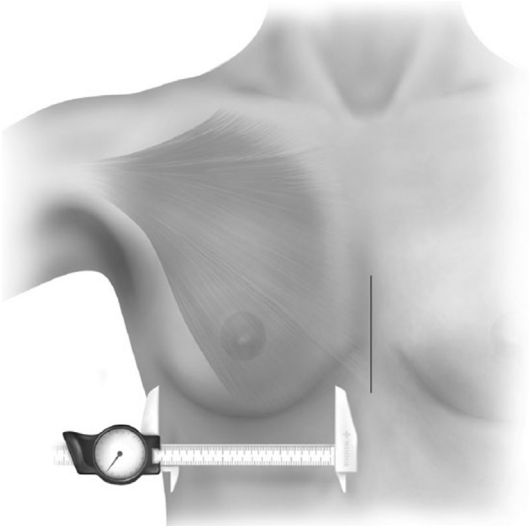

Fig. 3. The BBW measurement.

Photography

An instrumental part of the breast examination and patient education is patient photography. Together, the surgeon and patient can identify any asymmetries; in addition, this discussion allows the surgeon to reiterate that postoperative breasts will not be identical. Furthermore, by using photographs, the surgeon can outline important concepts, including likelihood of implant palpability, rationale for implant pocket dissection and incision choice, the expectations of cleavage and IMF, and the ideal implant. A useful adjunct to this discussion is a "breast-augmentation image analysis form" that guides the surgeon through the necessary points[1] (see **Fig. 2**).

Recently, 3-dimensional imaging has become an integral part of our consultation and patient education.[15] The various viewpoints from a 3-dimensional model exponentially surpass the information from a 2-dimensional photograph; thus, the patient and surgeon have visual data to augment tissue-based implant selection. Furthermore, simulated 3-dimensional images allow the patient to see a "natural" versus "augmented" look and can thus make an informed decision for implant selection.

IMPLANT SELECTION: TISSUE-BASED CLINICAL ANALYSIS AND PLANNING

Selecting the appropriate implant for breast augmentation remains a challenge for many plastic surgeons. Patients typically discuss magazine photographs, cup sizes, and friends' experiences when suggesting implants for their respective surgery. However, these subjective anecdotes have little value in selecting the proper implant for particular breast morphology. Recent premarket approval studies have documented elevated reoperation rates after breast augmentation from 15% to 24% in 6 years. With recent scientific studies,

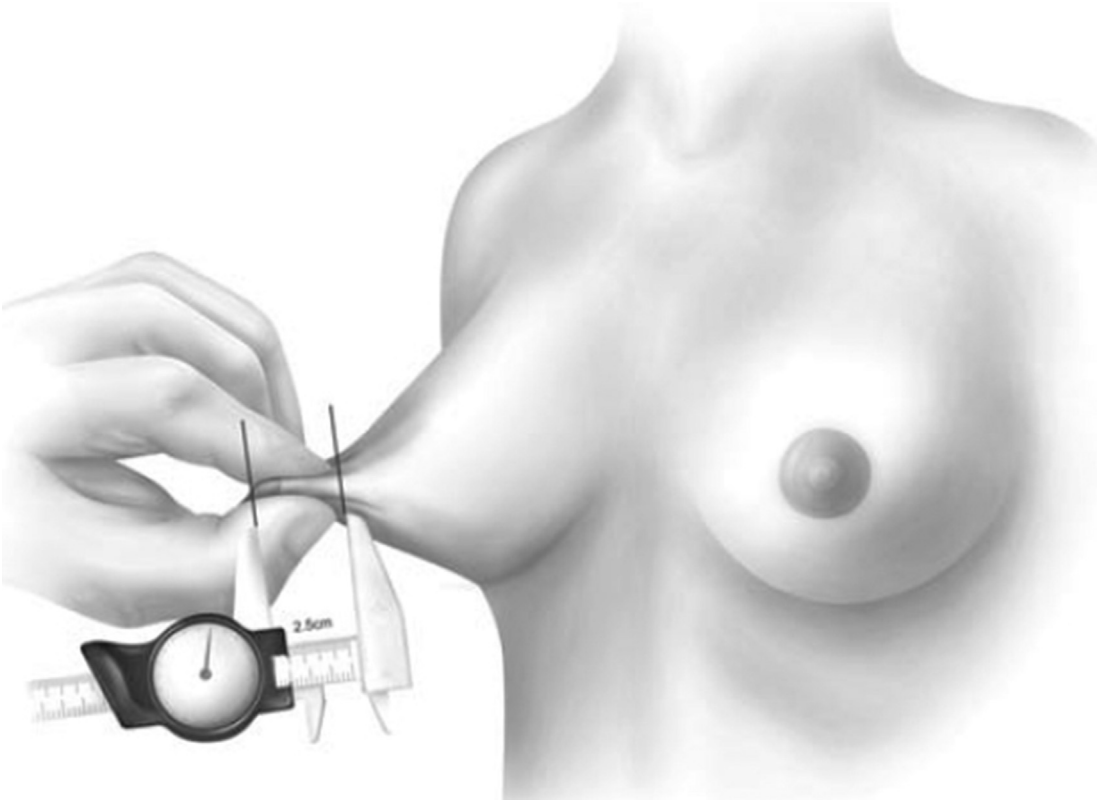

Fig. 4. The SS measurement.

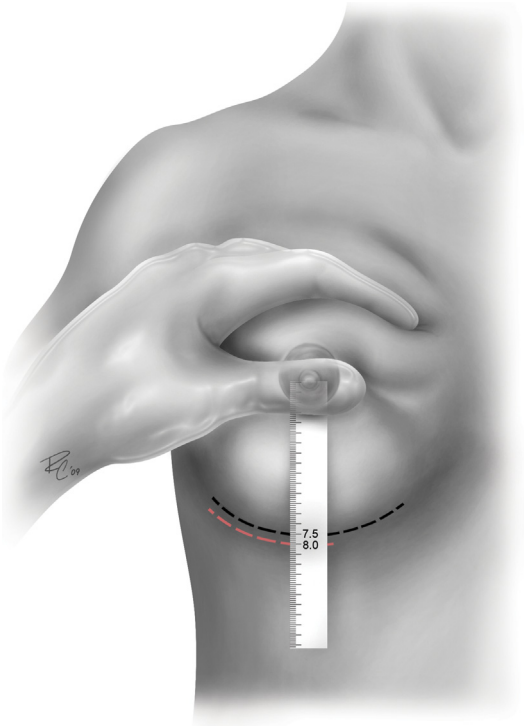

Fig. 5. The N:IMF measurement on stretch.

we now understand tissue-based planning concepts that can help lower reoperation rates for augmentation.[1,9]

Bra/Sizers Limitations

Some surgeons argue that volume is the most important variable in implant selection and suggest using sizers to select an implant. Preoperative sizing consists of placing sample implants in a bra to preview a range of possible results. Typically, the surgeon reviews the height, weight, and body habitus of the patient and then offers a size range of implants. Of note, patients are informed that the sizing bra may add 30 mL to each breast. Also, if a patient desires a saline implant, the selected implant should be 25 mL less than its silicone counterpart to allow for intraoperative overfilling and lower incidence of rippling. Based on this evaluation, a patient then selects 2 implants within 25 mL and the surgeon has the liberty to select the ideal implant based on intraoperative implant sizing and the breast mound. We have found the in-office bra sizer stuffing introduces more unknown variables into implant selection, making it more confusing to patients and actually misleading them in many cases.

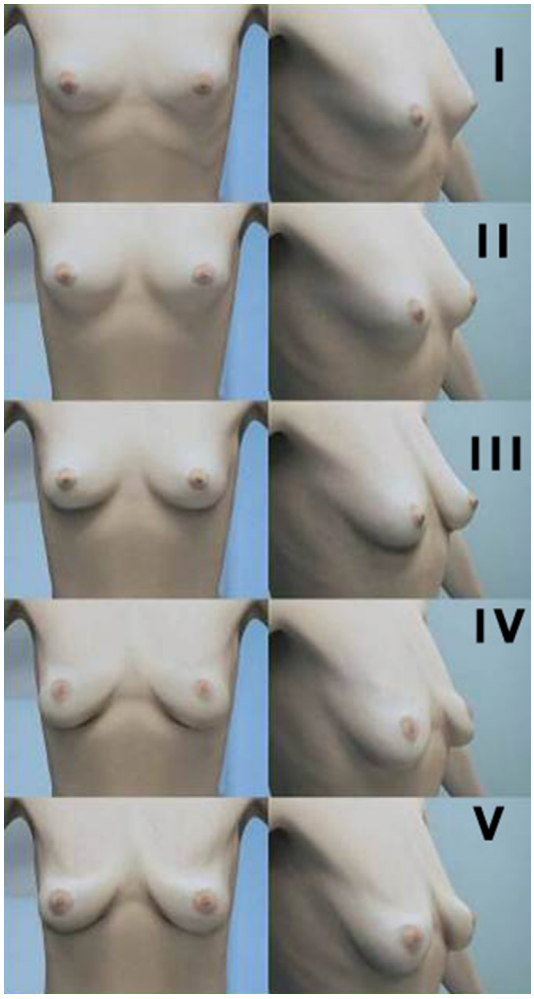

Fig. 6. The 5 breast subtypes based on envelope quality and N:IMF distance on stretch.

Even though this process shares ownership and has been proven to minimize size request changes,[4] this process has some deficiencies. There have been no studies that have compared the accuracy of preoperative breast sizing and postoperative breast volume and shape. This process is not influenced by the objective boundaries of the breast and is a very subjective experience. Furthermore, this process creates preoperative uncertainty and empowers the surgeon instead of the patient to select the final implant. If the surgeon and patient together choose the ideal implant based on the tissue envelope preoperatively, the patient knows the exact implant that will be placed in the operating room and has joint ownership of the implant decision. Furthermore, this process of intraoperative sizers includes increased operative time, which exposes the patient to increased capsular contracture, infection risk, and unwanted effects of general anesthesia (eg, nausea, stiffness). Despite the efforts to include patients in the implant process, the "sizer stuffing methodology" excludes patients from the final implant decision and lacks tissue-based preoperative planning.[4]

High-5 System

Our practice has abandoned the subjective limitations of sizing and uses the tissue-based High-5 system for implant selection and operative planning. By adopting these tenets, our practice has reduced our overall reoperation rate to 2.8% in comparison with the national reoperation rates.[14] The basics of the High-5 process allow the surgeon to make 5 critical decisions for optimal outcomes:

1. Pocket plane
2. Implant size
3. Implant type
4. IMF position
5. Incision

This process is outlined in detail in the 2006 article, "Five critical decisions in breast augmentation using five measurements in 5 minutes: the high five decision support process."[9] However, since its publication, we have made the following advances and simplifications to the 5 steps:

1. As previously discussed, our practice uses a dual-plane pocket for all patients with the exception of true body builders.
2. The measurements of BBW and SS determine optimal fill volume. If the patient is a breast type 1 or 2, the optimal fill volume is reduced further (60 mL and 30 mL, respectively). Any adjustments to the optimal fill based on the patient desires are made. Breast type provides a simpler construct to correlate envelope quality and tissue-based implant selection. Once the final optimal fill is known, 3-dimensional imaging using the desired implant at that optimal fill is performed with the patient.
3. The new inframammary fold incision and ideal postoperative nipple-to-fold distance is extrapolated from the High-5 chart based on the selected implant volume. If the recommended nipple-to-fold distance is greater than the preoperative nipple-to-fold distance, the surgeon should consider altering the fold to the suggested level. A general yet effective formula is a 300-mL implant requires a nipple-to-IMF distance of 8 cm; for every 10-mL volumetric change, the IMF position should adjust by 0.1 cm.

Fig. 7. Integration of BBW, SS, N:IMF distance, and breast type to create a blueprint for implant selection for implant-specific tissue-based planning. (Activas, Inc, Parsippany, NJ.)

4. As previously discussed, our practice uses an IMF approach for all patients. This approach provides optimal control with minimal tissue trauma and reduced exposure to implant contaminants, and passes the "family test"; ie, what incision would we recommend and perform on a family member?

Failure to follow tissue-based planning and natural boundaries of the breast can lead to an unnatural appearance as well as soft tissue distortion with inherent postoperative complications.[5] **Fig. 8** outlines our process for clinical evaluation and patient measurements to execute tissue-based implant selection.

Three-Dimensional Analyses

Even though 3-dimensional imaging has been referenced previously, the concept must be reiterated, as this technology has become an increasingly powerful educational instrument for both the surgeon and patient in the implant decision-making process. Three-dimensional imaging, unlike its historic 2-dimensional counterpart, allows the patient not only to see the breast from various angles but also to simulate postoperative results with the insertion of an implant. Once the surgeon and patient have applied tissue-based preoperative planning to select an implant, the two can visualize the implant in the 3-dimensional model.

Size: **Pt. Desires:** ☐Natural appearing breast o Unnatural, bulging upper breast
☐Proportionate to protect tissues o Very large
Approximate Desired Cup _____ Requests specific cc's: _____
o Pt.Chooses Size o Pt. Leaves Size Choice to Dr. Adams
Implant: o Round o Anatomic o Smooth o Textured
o Saline oSilicone oCohesive o Pt. Leaves Type Choice to Dr. Adams
Pocket Location: ☐PRP oRM oDr. Adams to decide
Incision Location: ☐M oPA oAX o Incision Choice to Dr. Adams
Pts. Initials _____

Capsular Contracture and Tissue Stretch Factors:
☐Implant choice may affect risk
☐Pt. accepts full responsibility for all costs (hospital and anesthesia) for any surgery necessary to treat capsule, tissue stretch deformities and aging implants. Revision surgery may exceed the costs of the original surgery. Pts. Initials_____

Patient Has Completed, Read and Signed:
☐Pt. Educator Consult ☐Choice Documents
☐Dr Adams website Pt. Ed. Initials: _____

Discussed/Patient Accepts That:
☐The larger the implant , the more risks of sensory loss, tissue damage, and increased risk for re-operations
Pts. Initials_____

Age _____
Height _____ Wt._____lbs
Frame: Sm Med Lrg
Torso: o Nl Wide Nr
Gravida _____
Para _____

Bra **Band** Size: 32, 34, 36
Breast **Cup** Size (Approx.)
Prior to pregnancy____
Largest with preg ____
Current Cup Size ____
Desired Cup Size ____
Previous Breast Disease:
None
Biopsies: o No o Yes
_____

Family Hx. Breast Cancer
No Yes
Mother Grandmother Aunt
Maternal Paternal

Previous Mammograms:
☐No ☐Yes
Date: _____
Interpretation: ☐Normal
☐Other: _____
Pertinent Medical History:
☐None
_____
_____
PSH: _____
_____

Smoker:☐No ☐Yes ____
Allergies: ☐NKDA
_____
Current Meds, Herbs, Vits:
_____

Companion: _____
Relation: _____

Specific Limitations Discussed with Patient:

☐Your breasts will never match
☐You may lose some or all sensation
☐You may see or feel edges of your implant due to thin tissues
☐You may require reoperations and additional costs in the future due to implant size requested , your tissue stretch characteristics or capsule you form
☐We give no guarantee of cup size
☐Any reoperation may require an inframammary incision
☐ Other:
_____

☐Patient vocalizes under-standing and acceptance of all items checked above. Pt. Initials _____

Breast Masses
☐None
☐Size and Location:
_____
_____
Larger Breast:
☐Left ☐☐Right
Est. Vol. Diff. _____ cc TBD
Nipple Level
Discrepancy _____ cm N/A
IMF Level
Discrepancy _____ cm N/A
Envelope Compliance
☐Nl ☐Inc ☐☐Dec
☐☐Constricted Lower Env.
☐☐Short, fixed IMF
☐☐Other:
_____
☐ **Note Dictated**

Clinical Breast Measurements L/R		Estimating Desired Breast Implant Volume Based on Breast Measurements and Tissue Characteristics High 5 System										
Breast BW		**Base Width Parenchyma (cm)**	**10.5**	**11.0**	**11.5**	**12.0**	**12.5**	**13.0**	**13.5**	**14.0**	**14.5**	**15.0**
		Estimated Initial Implant Volume (cc's)	**200**	**250**	**275**	**300**	**300**	**325**	**350**	**375**	**375**	**400**
SS_{MaxStr}		**If SS <2.0, – 30cc**										
		If SS >3.0, + 30cc										
		If SS >4.0, + 60cc										
$N:IMF_{MaxSt}$		**If N:IMF >9.5, + 30cc**										
Breast Type												
Pt. request												
		Total Estimated Implant Volume										
Estimating the Optimal Level of the Inframammary Fold Relative to the Nipple												
		For each volume indicated	**200**	**250**	**275**	**300**		**325**	**350**	**375**		**400**
New IMF		**Set new IMF at N:IMF distance (cm.) (measured under maximal stretch)**	**7.0**	**7.0**	**7.5**	**8**		**8.25**	**8.5**	**9.0**		**9.5**

SNN/N:IMF

R /
L /

R / L

BW /
SS /
AD /
SPP
IPP
PP /
PCEF %
C:IMF /
U:IMF /
ChCirc
Dome /
Breast Type:

Notes:

Implant Selected: _____ **Volume:** _____ **cc** **BaseD**_____**Ht:** _____ **cm.**

1. ST Coverage
SPP >2 SG, DP 1 2 3
SPP <2 RP, DP 1 2 3

4. IMF position _____cm N:IMF
☐Lower fold N:IMFpost____
☐Do not lower fold

5. Incision: ☐IMF ☐RT IMF ☐PA ☐IT IMF ☐TA

Top concerns:

Patient Name: **MRN:**
EDU Date:_____ **Consultation Date:**

Ref:
Resides in Occupation:

Fig. 8. Our intraoperative process for clinical evaluation and patient measurements to execute tissue-based implant selection.

With this postoperative 3-dimensional simulation, the surgeon and patient can confirm expectations based on a scientifically proven technology or make appropriate adjustments in the patient's own picture based on volume and shape to affirm the ideal implant.[15] Previous investigators, including our clinical practice, have verified the accuracy of the preoperative simulation and post-operative images for patient consultation. **Fig. 9** demonstrates an example of a 24-year-old woman who had preoperative breast imaging, preoperative simulation, and postoperative imaging using Allergan (Irvine, CA, USA) Style 15 to 265-mL round implants. Of note, surgeons must caution

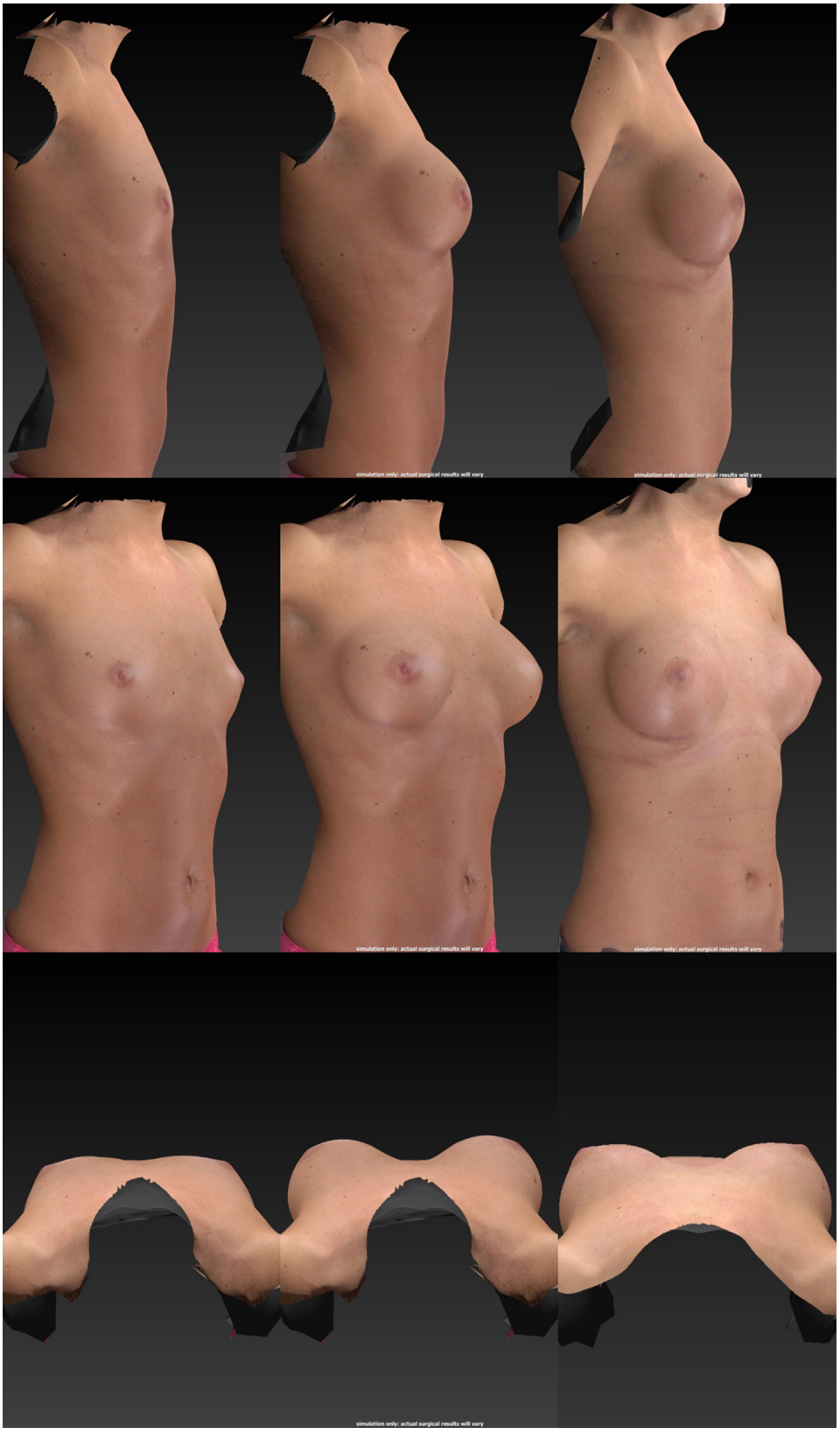

Fig. 9. A 24-year-old woman who had preoperative breast imaging, preoperative simulation, and postoperative imaging using Allergan Style 15 to 265-mL round implants.

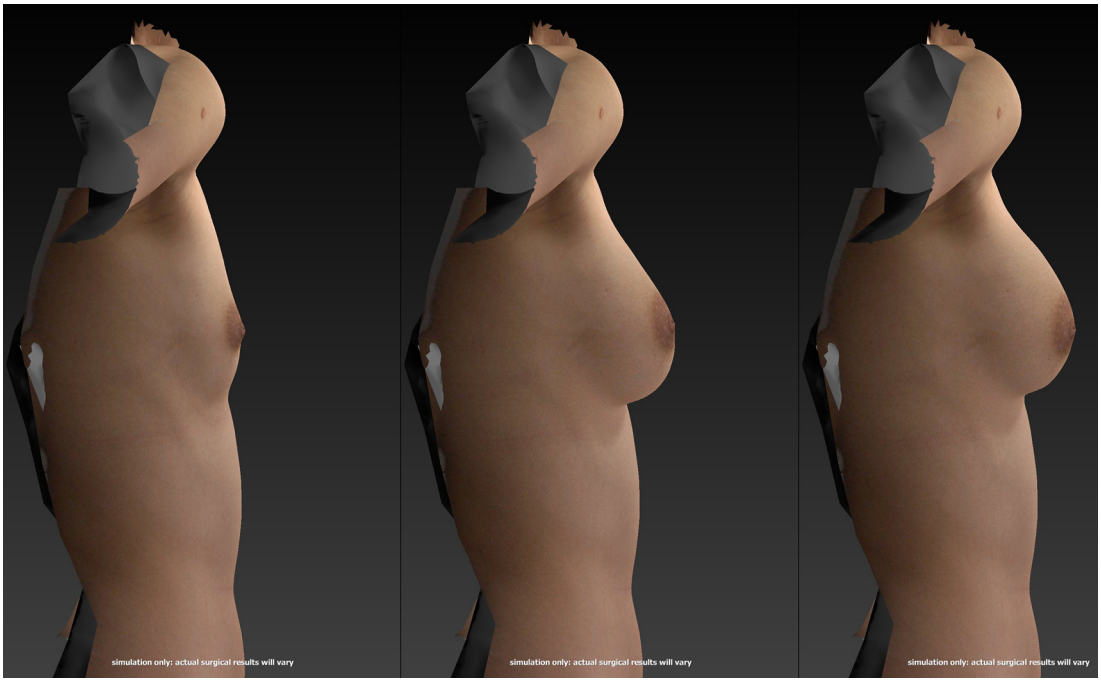

Fig. 10. A preoperative surgical simulation of a 24-year-old woman with an anatomic implant, Allergan FM 410 to 205 mL, and with a round implant, Sientra MP 230 mL.

patients that 3-dimensional imaging is only a simulation and by no means guarantees postoperative results. This is no different from rhinoplasty 3-dimensional imaging, which has been used successfully for many years. Despite this limitation, 3-dimensionalimaging enhances the communication between surgeon and patient and allows the patient to choose an implant based on an actual image of her body. In addition, with the resurgence of anatomic silicone implants in the US market, 3-dimensional imaging may serve as an adjunct to educating patients in different volume and surface characteristics. This technology has been particularly effective in demonstrating differences between a round versus shaped outcome for a given patient. **Fig. 10** represents a preoperative surgical simulation of a 24-year-old woman with an anatomic implant, Allergan FM 410 to 205 mL, and with a round implant, Sientra (Santa Barbara, CA, USA) MP 230 mL.

SUMMARY

Our practice has adopted the philosophy that breast augmentation is not simply a surgical procedure but a process of 4 comprehensive steps. The nonsurgical steps, patient education and tissue-based planning, have been detailed earlier in this article and are essential to optimizing postoperative outcomes and reducing reoperation rates. The surgeon and the patient must assume a mutual responsibility that the implant has been selected based on breast dimensions. Furthermore, they must have a shared understanding of preoperative breast asymmetry and soft tissue limitations. State-of-the-art advances include dedicated education, comprehensive patient/surgeon consultation, surgical forms and analytical sheets, and patient 3-dimensional imaging coupled with tissue-based planning. This breast augmentation process has been transferable to other practices with the same successes, and in the end, with the global adaptation of this approach, the winner is the patient.

Editorial Comments by Bradley P. Bengtson, MD

A great deal is owed to Dr Bill Adams in getting plastic surgeons to think about the surgical procedures that we are performing as a "Process" verses just an event or surgical procedure. The breast augmentation Process may be broken down into four main process categories. Although all are critical, as Dr Adams and colleagues point out, the Patient education, Patient selection and Implant selection are by far and away the most significant. Proper patient evaluation and education using Tissue Base Planning principles and the application of these measurements into the patient assessment is essential in obtaining objective, consistent outcomes and minimizing adverse events, complications and breast revision surgery.

REFERENCES

1. Adams WP Jr. The process of breast augmentation: four sequential steps for optimizing outcomes for patients. Plast Reconstr Surg 2008;122(6): 1892–900.
2. Tebbetts JB. Achieving a zero percent reoperation rate at 3 years in a 50-consecutive-case augmentation mammaplasty premarket approval study. Plast Reconstr Surg 2006;118(6):1453–7.
3. Tebbetts JB, Tebbetts TB. An approach that integrates patient education and informed consent in breast augmentation. Plast Reconstr Surg 2002; 110(3):971–8 [discussion: 979–81].
4. Hidalgo DA, Spector JA. Breast augmentation. Plast Reconstr Surg 2014;133(4):567e–83e.
5. Adams WP Jr, editor. Breast augmentation. 1st edition. New York: McGraw-Hill Professional; 2011.
6. Adams WP Jr, Mallucci P. Breast augmentation. Plast Reconstr Surg 2012;130(4):597e–611e.
7. Tebbetts JB. Dual plane breast augmentation: optimizing implant-soft-tissue relationships in a wide range of breast types. Plast Reconstr Surg 2001; 107(5):1255–72.
8. Tebbetts JB. Dual plane breast augmentation: optimizing implant-soft-tissue relationships in a wide range of breast types. Plast Reconstr Surg 2006; 118(7 Suppl):81S–98S [discussion: 99S–102S].
9. Tebbetts JB, Adams WP. Five critical decisions in breast augmentation using five measurements in 5 minutes: the high five decision support process. Plast Reconstr Surg 2005;116(7):2005–16.
10. Jacobson JM, Gatti ME, Schaffner AD, et al. Effect of incision choice on outcomes in primary breast augmentation. Aesthet Surg J 2012;32(4):456–62.
11. Wiener TC. Relationship of incision choice to capsular contracture. Aesthetic Surg J 2008;32(2):303–6.
12. Wiener TC. The role of betadine irrigation in breast augmentation. Plast Reconstr Surg 2007;119(1):12–5 [discussion: 16–7].
13. Huang GJ, Wichmann JL, Mills DC. Transaxillary subpectoral augmentation mammaplasty: a single surgeon's 20-year experience. Aesthet Surg J 2011; 31(7):781–801.
14. Adams WP. The High Five Process: tissue-based planning for breast augmentation. Plast Surg Nurs 2007;27(4):197–201.
15. Roostaeian J, Adams WP Jr. Three-dimensional imaging for breast augmentation: is this technology providing accurate simulations? Aesthet Surg J 2014;34(6):857–75.