Five Critical Decisions in Breast Augmentation Using Five Measurements in 5 Minutes: The High Five Decision Support Process

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Background: Surgeons' decisions impact patient outcomes and implant effects on tissues over time. Tissue assessment systems that provide quantitative, objective data enable objective rather than subjective decisions. First-generation dimensional systems for breast augmentation defined a desired result dimensionally and recommended an implant to force tissues to the desired result. A second-generation system, the TEPID system, defines measurements to match the implant to the patient's tissue characteristics, instead of forcing tissues to a desired result. This study defines a third-generation decision support process that prioritizes five critical decisions, identifies five key measurements, and completes all preoperative assessment and operative planning decisions in breast augmentation in 5 minutes or less.

Methods: Key decision parameters and data from more than 2300 primary augmentations planned using the TEPID system were analyzed to define the five most critical decisions that affect reoperation rates and risks of uncorrectable deformities and to define a decision support process using five critical measurements.

Results: In 1664 cases with up to 7 years of follow-up, the overall reoperation rate was 3 percent, and the reoperation rate for implant size exchange was 0.2 percent. The junior author's (Adams) clinical experience includes more than 300 augmentations with up to 6 years of follow-up using this system, with an overall reoperation rate of 2.8 percent.

Conclusion: The High Five decision support process prioritizes five critical decisions in breast augmentation and enables surgeons to address all preoperative assessment and operative planning decisions in breast augmentation in 5 minutes or less. (*Plast. Reconstr. Surg.* 116: 2005, 2005.)

When planning and performing primary breast augmentation, surgeons consider important alternatives and variables that determine short- and long-term results and the patient's risk of future tradeoffs, complications, and reoperations. Preoperative decision making is equally important compared with any aspect of surgical technique, because preoperative decisions determine the adequacy of soft-tissue coverage over the implant for the patient's lifetime, determine the weight and pressure that the implant device will exert on the tissues over time, and determine the position of the breast on the chest wall.

Identifying critical variables and decisions that affect outcomes and codifying those parameters into a simple, efficient, and reliable system provides surgeons with a framework for preoperative assessment and operative planning. Although more than 50 tissue and surgeon variables occur in every augmentation,[1]

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any clinically practical and adoptable decision process must focus on the few critical decisions and parameters that most affect outcomes.

A quantifiable approach to tissue assessment, using measurements in lieu of subjective visual assessment, provides surgeons with quantifiable data on which to base decisions. How a surgeon uses these data—decision priority, sequence, and algorithm—determines outcomes, tradeoffs, and reoperation risks. Previous dimensional systems for breast augmentation define a desired result and suggest methods to force tissues to that result.[2] The previously published TEPID system[1] incorporates quantitative tissue assessment, but instead of forcing tissues to a desired result, prioritizes soft-tissue coverage over the implant in the short and long term. The next logical step was to provide surgeons with a simple and efficient decision support process that addresses the five most critical decisions in breast augmentation, using only five measurements, with the entire assessment and planning process requiring 5 minutes or less—the High Five Process.

By integrating quantitative preoperative tissue assessment with a systematic approach to five critical decisions in breast augmentation, surgeons have an opportunity to improve outcomes, reduce reoperation rates, and improve practice efficiency. This article integrates a stepwise approach to five critical decisions in breast augmentation with a refined and simplified version of an established tissue assessment system for augmentation. The High Five decision support process adds a decision and management component to an established system for quantitative tissue assessment.

Five Critical Decisions in Breast Augmentation Planning

Surgeons must make preoperative decisions in five critical areas when planning a breast augmentation. Each of these decisions should be based on quantifiable measurements or data. In order of priority, these decisions define:

1. *Optimal soft-tissue coverage/pocket location for the implant.* This determines future risks of visible traction rippling, visible or palpable implant edges, and possible risks of excessive stretch or extrusion.
2. *Implant volume (weight).* This determines implant effects on tissues over time, risks of excessive stretch, excessive thinning, visible or palpable implant edges, visible traction rippling, ptosis, and parenchymal atrophy.
3. *Implant type, size, and dimensions.* This determines control over distribution of fill within the breast; adequacy of envelope fill; and risks of excessive stretch, excessive thinning, visible or palpable implant edges, visible traction rippling, ptosis, and parenchymal atrophy.
4. *Optimal location for the inframammary fold* based on the width of the implant selected for augmentation. This determines the position of the breast on the chest wall, the critical aesthetic relationship between breast width and nipple-to-fold distance, and distribution of fill (especially upper pole fill).
5. *Incision location.* This determines degree of trauma to adjacent soft tissues, exposure of implant to endogenous bacteria in the breast tissue, surgeon visibility and control, potential injury to adjacent neurovasculature, and potential postoperative morbidity or tradeoffs.

A comprehensive system for implant selection should address each of these critical decision areas and provide the surgeon with specific, quantifiable data to consider when making decisions and assessing outcomes.

Background of the TEPID System

The TEPID system [tissue characteristics of the breast (T), the envelope (E), parenchyma (P), implant (I), and the dimensions (D) and dynamics of the implant relative to the soft tissues] for breast implant selection, based on the patient's individual tissue characteristics and breast dimensions, was published in this *Journal* in April of 2002.[1] The system has been refined and simplified to include only five measurements that address five prioritized decisions in implant selection and operative planning for breast augmentation that surgeons can complete in 5 minutes. This process is designed to address essential parameters that affect aesthetic results, compromises, complications, and reoperation risks in breast augmentation. Additional clinical experience with the TEPID system has redefined priorities in decision making and created a simpler and more efficient process for surgeons gaining

familiarity with quantitative decision making in breast augmentation—the High Five process.

The TEPID system evolved from the senior author's (Tebbetts) experience with the first dimensional system (later licensed by Inamed Corporation as the BioDimensional System) for breast augmentation,[2] a system that defined a patient's desired result by dimensions and then selected an implant to force tissues to the desired result. The BioDimensional System has been widely used by surgeons in the United States and internationally, but clinical experience with the system defined specific limitations that encouraged the development of the TEPID system.

The first-generation BioDimensional System (1) defines implant dimensions and volume that *force patient tissues to an arbitrary result* defined by patient and surgeon desires instead of quantitatively characterizing the patient's tissue dimensions and characteristics, and *selecting an implant to fit the requirements and limitations of the tissues*; (2) incorporates no system to limit volume and weight according to patient tissue characteristics, allowing patients and surgeons to define a desired result dimensionally and select implants that may be larger or more projecting than ideal for the patient's tissues, risking potential long-term negative tissue consequences that can be irreversible; (3) does not specifically address the number one priority in breast augmentation, that is, ensuring optimal soft-tissue coverage of the implant long-term; and (4) does not address a critical third dimension, tissue stretch, which is a critical measurement to estimate volume required for optimal envelope fill.

The TEPID system was designed to specifically address the limitations of the first-generation BioDimensional System by defining a paradigm shift in planning breast augmentation. Instead of forcing tissues to a desired result defined by the patient and surgeon, the TEPID system encourages patient and surgeon to prioritize the long-term welfare of the patient's tissues and ensure optimal soft-tissue coverage over the implant to minimize negative tissue consequences long term and minimize reoperation rates. The TEPID system is designed to help patient and surgeons reconcile *wishes* with the *tissues* by quantifying important tissue characteristics and helping patients reconcile their preconceived desires for a specific result with the realities of their tissues. The High Five process presented in this article further focuses and simplifies an established system of quantitative patient tissue assessment and adds a defined decision support process.

CLINICAL EXPERIENCE

The senior author's (Tebbetts) clinical experience with the TEPID system includes more than 2000 primary breast augmentation cases. In three series reported in this *Journal*, with up to 7 years of follow-up of 1664 reported cases, the overall reoperation rate was 3 percent, and the reoperation rate for implant size exchange was 0.2 percent.[3–5] The junior author's (Adams) clinical experience includes more than 300 augmentations with up to 6 years of follow-up using this system, with an overall reoperation rate of 2.8 percent.[6] Although these rates are from a single surgeon's experience, these data provide an interesting comparison with the overall reoperation rates of 17 percent and rates for size exchange or adjustment rates of 8.7 percent from the averaged data of Mentor and McGhan submitted for their saline premarket approval studies in 2000.[7,8]

Additional experience by the authors and input from other colleagues and residents further codified and refined the TEPID system to a comprehensive decision support process that specifically addresses five critical decisions in breast augmentation.

For efficiency, the High Five process does not include any parameters that are not essential to one of these decisions, and the process enables surgeons to perform all measurements and make all implant selection and operative planning decisions in 5 minutes or less.

MEASUREMENTS, IMPLANT SELECTION, AND OPERATIVE PLANNING

With the patient sitting and the High Five Clinical Evaluation and Operative Planning Form (Fig. 1) resting in the patient's lap, the surgeon performs five measurements, records the measurements, and makes five prioritized decisions within 5 minutes or less. During the process, the surgeon can discuss the measurements, decisions, implications, and tradeoffs with the patient.

A copy of the High Five Clinical Evaluation and Operative Planning Form is downloadable from the *Journal*'s Web site at www.plasreconsurg.org, along with a video file including measure-

High Five Tissue Analysis and Operative Planning

Patient Name:		Date:	
1. COVERAGE- Selecting Pocket Location to Optimize Soft Tissue Coverage Short- and Long-Term			
STPTUP		If <2.0 cm, consider dual plane (DP) or partial retropectoral (PRP, pectoralis origins intact across IMF)	DP
STPTIMF		If STPTIMF <0.5 cm, consider subpectoral pocket and leave pectoralis origins intact along IMF	PRP
POCKET LOCATION SELECTED BASED ON THICKNESS OF TISSUE COVERAGE			RM

2. IMPLANT VOLUME- Selecting an Estimated Implant Volume for Optimal Envelope Fill												
Estimating Desired Breast Implant Volume Based on Breast Measurements and Tissue Characteristics												
Base Width		B.W. Parenchyma (cm)	10.5	11.0	11.5	12.0	12.5	13.0	13.5	14.0	14.5	15.0	
		Initial Volume (cc)	200	250	275	300	300	325	350	375	375	400	cc
$APSS_{MaxStr}$		If APSS < 2.0, - 30cc; If APSS > 3.0, + 30cc; If APSS > 4.0, +60cc Place appropriate number in blank at right											cc
$N:IMF_{MaxSt}$		If N:IMF > 9.5, + 30cc Place appropriate number in blank at right											cc
PCSEF %		If PCSEF < 20%, + 30cc; If PCSEF > 80%, - 30cc Place appropriate number in blank at right											cc
Pt. request													cc
NET ESTIMATED VOLUME TO FILL ENVELOPE BASED ON PATIENT TISSUE CHARACTERISTICS													cc

3. IMPLANT DIMENSIONS, TYPE, MANUFACTURER- Selecting specific implant characteristics					
Implant Manufacturer	Implant Style/Shape/Shell/Filler Material	Implant Vol (cc)	*Implant Base Width	Breast Base Width	Implant Projection
		cc	cm	cm	cm
*For optimal long-term coverage, implant base width should not exceed base width of patient's existing parenchyma, even if wider IMD results.					

4. INFRAMAMMARY FOLD LOCATION- Estimating desired postoperative inframammary fold position											
(Circle Volume closest *to net estimated implant volume* calculated above, and *circle suggested N:IMF* in the cell beneath that volume)											
		Volume closest to calculated "total estimated implant volume" above	200	250	275	300	325	350	375	400	
		Recommended new N:IMF distance (cm) under maximal stretch►	7.0	7.0	7.5	8	8	8.5	9.0	9.5	
*Planning Level of New Inframammary Fold**	Transfer the patient's $N:IMF_{MaxSt}$ measurement from above to corresponding cell at right. Then transfer the High Five recommended new N:IMF to the corresponding cell at right. If the patient's preop N:IMF is shorter than the High Five recommended new N:IMF, consider lowering the fold. If the patient's preop N:IMF is equal to or greater than the High Five recommended new N:IMF, no change in IMF position is indicated.				Patient's Preoperative $N:IMF_{MaxSt}$		High Five Recommended $N:IMF_{MaxSt}$		Change In Fold Position	Lower Fold	
					cm		cm		Yes/ No	cm	
*Other factors may affect optimal IMF level and require surgeons to modify the High Five System recommendations for N:IMF F.											

5. INCISION LOCATION- Selecting desired incision location			
Inframammary	Axillary	Periareolar	Umbilical

FIG. 1. High Five Clinical Evaluation and Operative Planning Form.

ment techniques and the entire decision-making process. Details and illustrations of the required measurements and estimates are included in the previous system[1] and are abbreviated in this report.

Soft-Tissue Coverage and Pocket Selection

The surgeon performs the first two measurements and records the measurements on the evaluation sheet (Fig. 1, *section 1*):

STPTUP: soft-tissue pinch thickness of the upper pole (skin and subcutaneous tissue superior to the breast parenchyma (Fig. 2, *above*).

STPTIMF: soft-tissue pinch thickness at the inframammary fold (Fig. 2, *below*).

Implant pocket selection is based on quantified soft-tissue coverage to ensure optimal long-term coverage over the implant. If soft-tissue pinch thickness of the upper pole is less than 2.0 cm, the surgeon chooses a dual-plane or partial retropectoral pocket location to ensure optimal soft-tissue coverage. Adding fascial coverage (retromammary, subfascial pocket) of less than 1 mm thickness is inconsequential long term when pectoralis muscle coverage is available and when dual-plane tech-

niques enable surgeons to minimize tradeoffs of traditional retropectoral placement. When selecting a dual-plane or partial retropectoral pocket location to optimize coverage, the surgeon *never* divides origins of the pectoralis major from the sternal notch to the sternal junction with the inframammary fold to ensure optimal coverage in this critical area, regardless of a patient's desired intermammary distance. If soft-tissue pinch thickness at the inframammary fold is less than 0.5 cm, the surgeon preserves intact pectoralis muscle origins along the inframammary fold for additional coverage, creating a partial retropectoral pocket (compared with a dual-plane pocket in which the surgeon divides pectoralis origins along the fold). Considering the quantified measurements of soft-tissue thickness, the surgeon chooses either dual-plane 1, 2 , 3, partial retropectoral, or retromammary pocket location, and circles the choice on the form.

Implant Volume

Next, the surgeon measures and records the following parameters (Fig. 1, *section 2*):

Base width (*BW*) of the existing breast parenchyma, a linear measurement (Fig. 3).

Anterior pull skin stretch (*APSS*), a measurement of maximal anterior skin stretch by manual traction comfortably tolerated by an awake patient (Fig. 4).

Nipple-to-inframammary fold distance (*N: IMF_{MaxSt}*), measured under maximal stretch (Figs. 5 and 6).

Parenchyma to stretched envelope fill (*PCSEF*), an estimate of the contribution of the patient's existing breast. To estimate the parenchyma to stretched envelope fill, the surgeon pulls the periareolar skin maximally anteriorly (anterior pull skin stretch), then cups the hand or envisions the envelope stretched

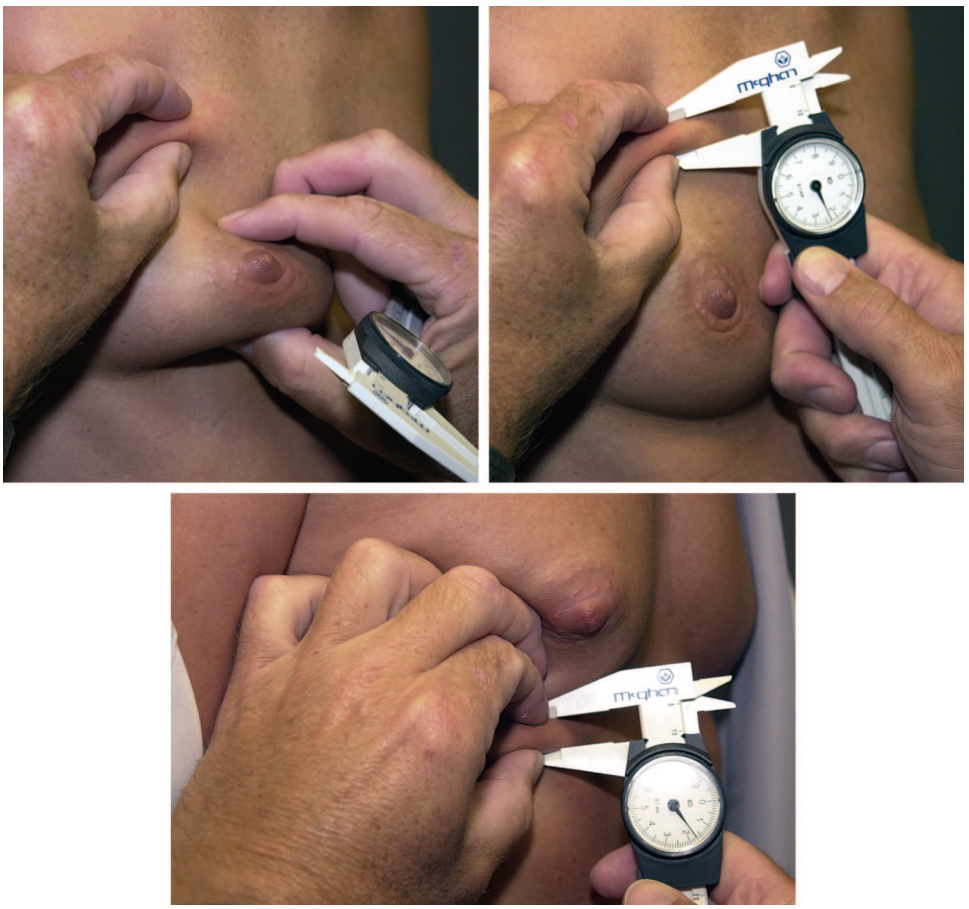

FIG. 2. (*Above*) Measure soft-tissue pinch thickness of the upper pole by isolating skin and subcutaneous tissue superior to the breast parenchyma, pinching firmly, and measuring the thickness with a caliper. (*Below*) Measure soft-tissue pinch thickness at the inframammary fold by isolating skin and subcutaneous tissue at the inframammary fold, pinching firmly, and measuring the thickness with a caliper.

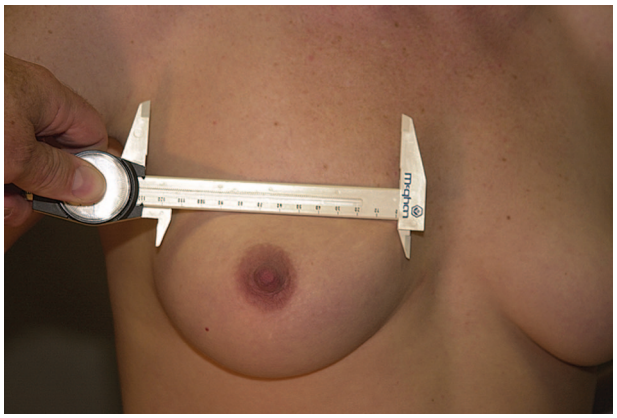

FIG. 3. Measure the base width of the breast mound as a linear measurement from the visible medial border of the breast mound to the visible lateral border of the breast mound in front view.

this same amount over the entire breast and estimates the amount of fill as a percentage that the patient's existing parenchyma will provide to the maximally stretched envelope.

The surgeon then locates the base width that corresponds with the patient's base width in the row to the right. In the cell immediately beneath, the surgeon circles the initial estimated desired implant volume for that base width breast and transfers this number to the blank space at the far right of the row.

This volume represents an *estimated desired implant volume* based on the breast base width. These volumes were derived from data described in the initial TEPID report[1] and are adjustable by the surgeon, depending on other parameters, including patient wishes. Next, the surgeon adjusts the estimated starting volume, depending on skin stretch.

If anterior pull skin stretch is less than 2 cm (very tight envelope), the surgeon subtracts 30 cc (or another increment of the surgeon's preference) from the estimated starting volume. If anterior pull skin stretch is greater than 3 cm, the surgeon adds 30 cc, and if anterior pull skin stretch is greater than 4 cm, the surgeon adds 60 cc to the starting volume, recording the appropriate addition or subtraction in the cell at the far right of the APSS row.

If the nipple-to-inframammary fold distance is greater than 9.5 cm when measured under maximal stretch, the surgeon adds 30 cc (or another increment of the surgeon's preference) to the starting volume to provide adequate additional fill volume for a larger lower envelope. If applicable, the surgeon records this additional volume in the far right cell of the $N{:}IMF_{max\ stretch}$ row.

The parenchyma fill estimate is necessary to adjust volume for patients whose skin envelopes are tighter (anterior pull skin stretch < 2 cm) and already filled with parenchyma (parenchyma fill > 80 percent), or for patients with very lax skin envelopes (anterior pull skin stretch > 3 cm) who have very little breast parenchyma (< 20 percent). If parenchyma fill is greater than 80 percent (already full envelope), the surgeon subtracts 30 cc from the initial estimated volume, and if parenchyma fill

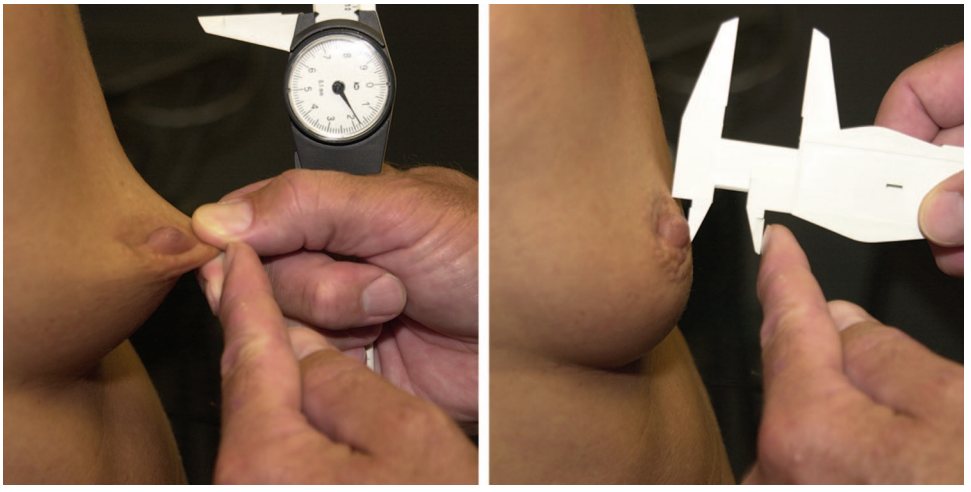

FIG. 4. (*Left*) Measure anterior pull skin stretch by grasping the skin of the areola and pulling it maximally anteriorly (while holding a caliper in the same hand), and then mark that point with a fingernail on the opposite hand. (*Right*) To complete the measurement of anterior pull skin stretch, release the skin and caliper measure from the point marked by the fingernail back to the resting plane of the areola.

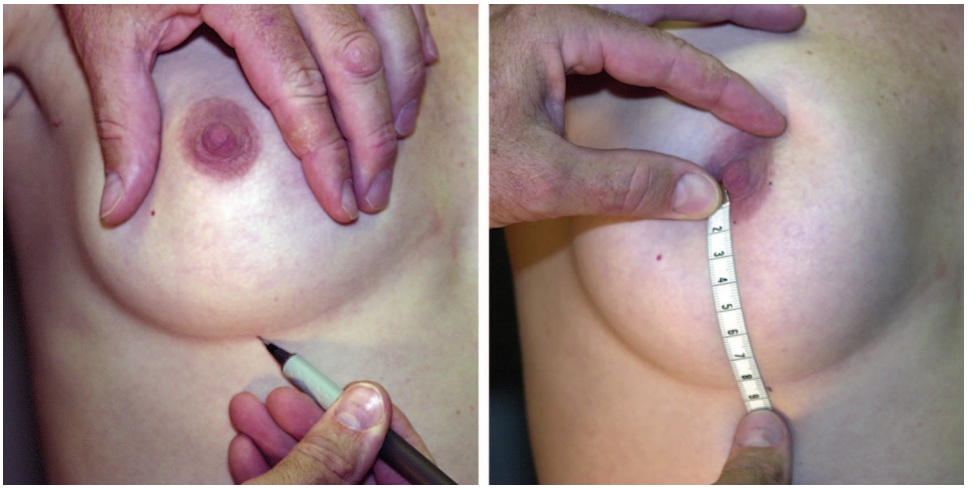

FIG. 5. To measure nipple-to-inframammary fold distance under maximal stretch, first place dots at the exact inframammary fold crease near the 6-o'clock position and just medial to the midpoint of the nipple. Place the tip of a flexible tape measure exactly at the dot beside the nipple, lift maximally to place the lower pole skin under maximal stretch, and measure to the dot at the inframammary fold.

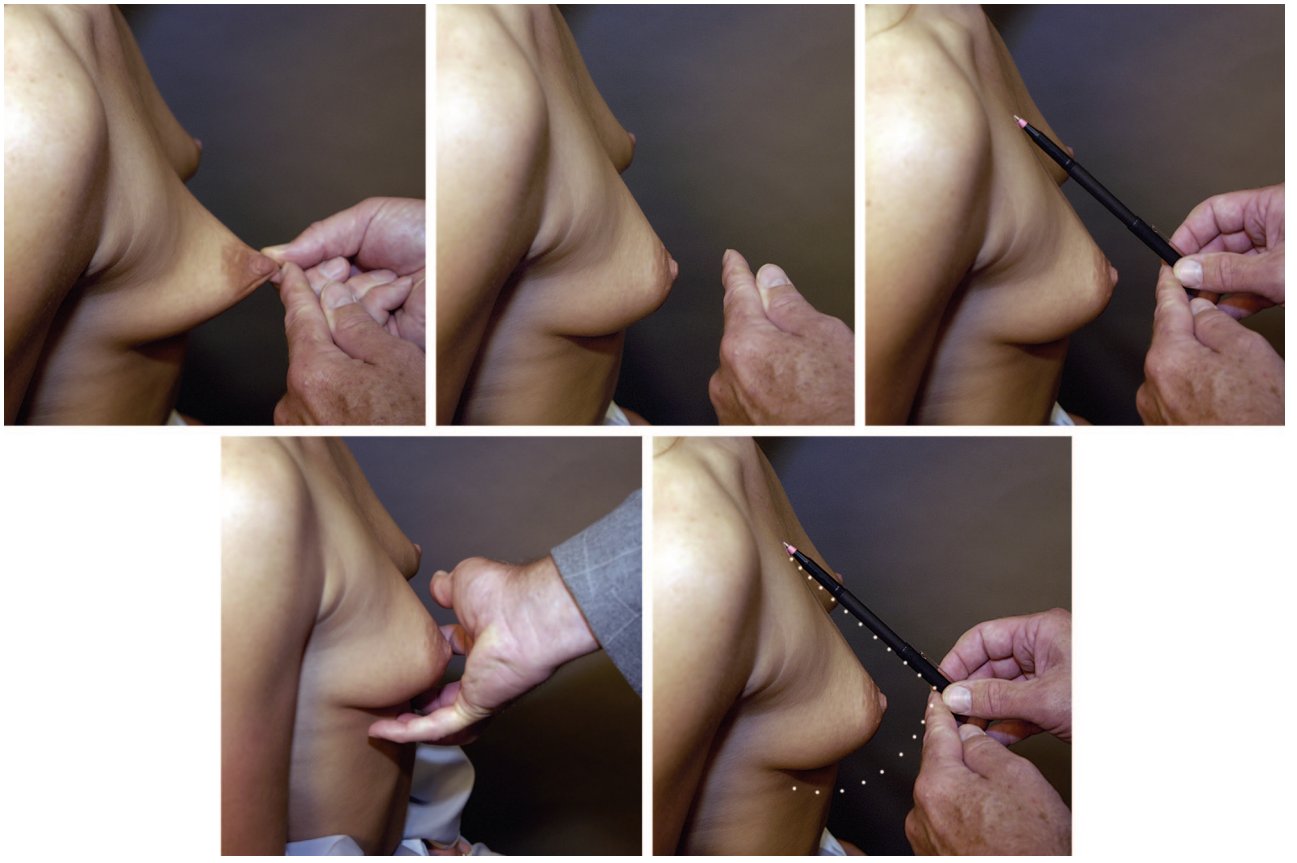

FIG. 6. (*Above*, *left* and *center*) To estimate parenchymal contribution to stretched envelope fill, first measure the anterior pull skin stretch by the techniques described previously. (*Above*, *right*) Place a pen or envision a line from the point of maximal stretch tapering into the upper pole. (*Below*, *left*) Cup the hand or envision a curved line that parallels the lower pole profile of the breast at a distance equal to anterior pull skin stretch. (*Below*, *right*) The *white dotted line* simulates the maximally stretched envelope for this patient based on the patient's anterior pull skin stretch. Envision this line, and estimate the percentage of this stretched envelope that is filled by the patient's existing parenchyma. This concept is easy to demonstrate to the patient using the pen and cupped hand.

is less than 20 percent (empty envelope), the surgeon adds 30 cc and records applicable additions or subtractions in the cell to the far right of the PCSEF row.

If the patient or surgeon desires a greater or lesser volume than the system recommends, the surgeon can add or subtract an additional volume increment and record it in the space provided in the far right cell of the Patient Request row. The High Five System does not replace patient or surgeon preferences or choices. The system provides guidelines based on quantified tissue characteristics of each individual patient. By adding or subtracting increments described above from the initial estimated volume, the surgeon derives a *net estimated volume* that is appropriate for the patient's quantified tissue characteristics and records the appropriate number in the cell at the far right of the Net Estimated Volume row.

Implant Type and Dimensions

The High Five System applies to a wide range of implant types, sizes, and dimensions (Fig. 1, *section 3*). Having derived a net estimated implant volume based on quantified tissue parameters, the surgeon can then consult size and dimension charts for any type of implant, and select implant dimensions (width, height, projection) that the surgeon feels are most appropriate.

The surgeon records the implant volume, the base width of the implant selected, the base width of the patient's existing parenchyma (measured previously), and implant projection. *For optimal long-term coverage, the base width of the implant selected should not exceed the base width of the patient's existing parenchyma, except in cases of tubular breasts, severely constricted lower pole breasts, or breasts with a base width less than 10.5 cm.* Implant projection is an important dimension that may affect distribution of fill and tissue consequences postoperatively and is included only for postoperative reference. Surgeons should consider potential irreversible parenchymal atrophy effects when selecting highly projecting implants.

Inframammary Fold Location

The ideal nipple-to-inframammary fold distance to mark preoperatively and set intraoperatively depends on the projected width of the postoperative breast (Fig. 1, *section 4*). To estimate the optimal level of the inframammary fold, the surgeon first locates the volume closest to the previously calculated net estimated implant volume. In the cell immediately beneath, the system lists a "Recommended new N:IMF distance (cm) under maximal stretch." The surgeon circles the recommended number and then transfers that number to the cell in the row below labeled "High Five recommended $N:IMF_{MaxSt}$." Next, the surgeon transfers the preoperative $N:IMF_{MaxSt}$ measurement to the cell labeled "Patient's Preoperative $N:IMF_{MaxSt}$" in the same row.

If the recommended intraoperative N:IMF for the planned volume implant is greater than the patient's preoperative $N:IMF_{MaxSt}$, the surgeon should consider lowering the fold to the recommended level. If the recommended $N:IMF_{MaxSt}$ is the same or longer than the patient's preoperative $N:IMF_{MaxSt}$, no lowering of the fold is indicated. After comparing the preoperative N:IMF with the recommended N:IMF, the surgeon decides whether to lower the fold, and circles either "Yes" or "No." If the choice is to lower the fold, the surgeon then records the appropriate number of centimeters to lower the fold in the cell below "Lower the Fold."

Incision Location

Incision location is based on patient preference, patient considerations of degree of surgical control, tissue trauma, and tradeoffs, and surgeon preferences and skill set. The surgeon records the planned incision location in the appropriate space in Figure 1, *section 5*.

Discussion

An accurate, efficient decision support process defines priorities and identifies a minimal number of essential decisions and provides quantifiable parameters on which to base those decisions. When prioritizing soft-tissue *coverage* in breast augmentation, two pinch thickness measurements are a minimum for making decisions regarding muscle coverage and location of muscle coverage. To estimate an appropriate *volume* for an envelope, minimum parameters include base width, skin stretch, nipple-to-inframammary fold measurement, and the contribution of the patient's existing breast parenchyma to stretched envelope fill (envelope fill equals implant plus parenchyma).

Optimal volume for a breast soft-tissue envelope is the *least* volume that is required to either (1) achieve the desired result in a previously unstretched breast or (2) adequately fill

a previously stretched envelope and ensure optimal soft-tissue coverage and minimize negative tissue effects by the implants. When forcing tissues to a desired result, surgeons and patients must carefully consider potential tissue consequences and possible uncorrectable deformities that may occur long term. Instead of forcing tissues to a desired result, the High Five process estimates a volume the tissues are likely to tolerate without selecting an implant that is wider than the patient's existing parenchyma (sacrificing coverage medially and laterally) and without adding excessive weight that can produce irreversible tissue changes.

Having determined an optimal estimated volume for an individual patient's envelope, the surgeon can then select implant type and dimensions to control the distribution of that volume within the breast. For any specific volume, implant width, projection, and height can vary. Width is the most important parameter affecting volume because of its range of variability and the effect of a change in width on a change in volume. Height of an implant in vivo depends on many factors, including overlying tissue characteristics, implant fill volume relative to mandrel volume, implant filler characteristics, and implant shell–filler interactions. Because implant height is so variable in vivo in non–form stable devices and is difficult to measure accurately, implant width and projection are the most clinically significant parameters.

Refinements to the system address suggestions from surgeons and residents who use the system routinely to assist with augmentation decisions. For resident education, this decision support process provides a codified, logical template with priorities and specific measurement techniques that allow residents to make decisions based on quantifiable parameters instead of stuffing test implants into bras or using other arbitrary and subjective methods.

The High Five process suggests an initial estimated implant volume based on the base width of a patient's breasts. The volume this system recommends is *an averaged volume for a range of implant devices that provides maximum volume without exceeding the base width of the patient's existing parenchyma.* These volumes were derived from implant width–volume relationships from implant manufacturers' size chart publications for all implant types (saline and silicone) in the United States. Averaging the dimension–volume relationships provided a range of volumes for implant widths at half-centimeter increments. To make the system easier to use and memorize, the volume increments were rounded to the nearest 25-cc increment.

Surgeons can base decisions of breast implant size and implant pocket location on subjective and arbitrary patient and surgeon preferences or can base decisions on quantifiable data to characterize individual patient tissue characteristics. Scientific analysis and evidence-based outcomes analysis require quantified data. Reoperation rates of 15 to 20 percent in multiple premarket application studies over the past two decades with silicone and saline implants[9–11] suggest an opportunity for better decision-making processes by surgeons and patients. Reoperations for size exchange, visible rippling or wrinkling, implant malposition, implant exposure or extrusion, ptosis, and other deformities can relate directly to the consequences of decisions that the patient and the surgeon make preoperatively.

Establishing quantitative criteria for optimal soft-tissue coverage, implant pocket location, and implant size can significantly affect overall reoperation rates.[3–6] Comprehensive, staged patient education is essential to help patients understand and accept responsibility for the potential long-term implications of their wishes and their decisions.[12] A process that prioritizes decisions, provides quantified data to assist with decisions, and defines specific criteria for soft-tissue coverage and implant volume based on individual patient tissue characteristics is an additional tool for surgeons and patients.

Any system that suggests a volume range relative to the width of breast parenchyma (prioritizing soft-tissue coverage) mandates a balance between implant width, height, and projection. Volume is weight, and weight applied to breast envelope tissues over time has consequences that are obvious to anyone who has observed a D-cup breast at age 18 and the same breast at age 30 or later, and obvious to anyone who has seen the effects of pregnancy on the breast. For any base width implant, increasing implant projection requires an increase in the volume (weight) of the implant. Increased projection also can place additional pressure on overlying tissues—breast parenchyma, subcutaneous tissue, and skin. Increasing projection, therefore, has two potentially negative tissue consequences: increasing weight effects and in-

creased pressure effects. Weight and pressure over time can cause stretch and thinning of the envelope, and focal pressure or excess pressure over time can cause atrophy of parenchyma and subcutaneous tissue. Envelope thinning and parenchymal atrophy are irreversible and may permanently preclude a patient from having optimal soft-tissue coverage, increasing risks and decreasing results of any future reoperations.

Implant manufacturers currently provide surgeons and patients with the widest array of implant device dimensions in history, enabling patients and surgeons to choose a device with dimensions (size and volume) to force tissues into virtually any configuration a patient may desire. Forcing tissues to go where they have never been (and some might argue, were never intended to go) has potential short- and long-term tissue consequences, some of which are irreversible. Whether a system of implant selection is purely dimension based, volume based, or a combination of dimension and volume (e.g., the High Five process), negative tissue consequences are usually the result of excessive weight (volume), pressure (projection), or both. What is "excess" weight or projection depends on individual patient tissue characteristics, and surgeons must individualize clinical judgments in each case.

One important question is whether patients and surgeons have an inherent right to place any volume they desire in a breast. The answer is yes, provided both are aware of and willing to accept responsibility for potential tissue consequences. A second important question is whether a process recommends volumes that satisfy patients while protecting tissues. Although this is a difficult question to answer scientifically, in published reports of 1664 cases with up to 7 years of follow-up,[3–5] when integrated with staged, repetitive patient education, the volumes recommended by the system produced results that resulted in 3 percent overall reoperation rates and a reoperation rate of 0.2 percent for size exchange. In an independent review, the junior author has clinical experience with over 300 augmentations over a 6-year period using this system, producing an overall reoperation rate of 2.8 percent and a 0.4 percent reoperation rate for size exchange.[6] Optimal preoperative patient education, patient decision support, and informed consent processes that document patient accountability for requests and decisions are critical. The High Five process does not replace or define patient or surgeon preferences or choices. Instead, it prioritizes decisions, provides guidelines based on quantified tissue characteristics of each individual patient, and provides an opportunity for surgeons to consider patient requests during the process and make choices outside the recommendations of the system.

To ensure optimal, long-term coverage, the base width of a breast implant should not exceed the base width of the patient's parenchyma. In practice, this means that surgeons must be willing to explain to patients that narrowing the intermammary distance (cleavage gap) surgically requires placing an implant edge medial to existing parenchymal coverage, risking edge visibility, palpability, and traction rippling long term. Each of these problems is largely uncorrectable, especially if surgeons divide medial origins of the pectoralis to narrow the intermammary distance. These problems are almost totally preventable by advising patients that narrowing of the cleavage gap is more safely accomplished by pushing the breasts with a bra compared with surgically placing an implant under thin, inadequate soft-tissue coverage, and confirming the patient's acceptance of these facts in informed consent documents.

In patients with extremely narrow base width breasts (body width < 10 cm) or tubular or severely constricted lower pole breasts, achieving a satisfactory aesthetic result may require an implant with a base width that exceeds the base width of the existing parenchyma. In these cases, patients and their surgeons should thoroughly discuss the potential long-term tradeoffs and tissue consequences (i.e., thinner areas of tissue, palpable or visible implant edges or shell, and visible traction rippling) and arrive at a mutually acceptable risk–benefit decision.

In aesthetically appealing breasts, the wider the breast, the longer the nipple-to-inframammary fold distance. The inframammary fold is the only fixed landmark on the breast, and determining optimal inframammary fold position at the time of breast augmentation is a major factor that affects the aesthetic result.

An excessively short nipple-to-inframammary fold distance relative to breast width produces a wide, boxy appearing breast with inadequate lower pole dimensions and fill. An excessively long nipple-to-inframammary fold distance relative to breast width produces a "bottomed out" appearance, with excessive lower pole dimen-

sions and fill often accompanied by upward tilt nipple-areola malposition. The premise that surgeons should never lower the inframammary fold ignores the critical aesthetic relationship between breast width (determined largely by implant base width) and nipple-to-inframammary fold distance that defines optimal postoperative aesthetics. When indicated, lowering of the inframammary fold is a critically important maneuver in breast augmentation, and it is accurate and predictable when surgeons use optimal measurements and techniques.

Many factors, including stretch factors that surgeons cannot control, can affect inframammary fold position long term, but surgeons need basic guidelines during operative planning to decide whether repositioning of the inframammary fold may be necessary for optimal aesthetics. The High Five guidelines for inframammary fold position are derived from preoperative and postoperative measurement data on large numbers of patients[1] and can be modified by surgeons according to specific clinical situations and considerations.

The High Five process is currently being used not only by surgeons but also by clinical assistants, patient educators, and by patients who wish to perform self-assessment as part of their educational process. In the senior author's (Tebbetts) practice, many out-of-town patients who express an interest receive a special, condensed version of the High Five Clinical Evaluation Form with numbered instructions by e-mail. Interestingly, their self-assessments have been extremely accurate, and the majority of these patients fully understand the concepts of the system.

CONCLUSIONS

The refined and simplified TEPID system, evolved into a decision support process, the High Five process, defines five critical decisions in primary breast augmentation and allows surgeons and patients to quantify individual patient tissue characteristics and to base decisions about soft-tissue coverage (implant pocket location) and implant volume (size, weight, and dimensions) on objective parameters instead of subjective, arbitrary parameters. The High Five process is a comprehensive yet simple and efficient decision and management model for primary breast augmentation.

The process addresses five critical priorities and decisions in breast augmentation: optimal soft-tissue coverage, implant size (volume/weight), implant dimensions, location of the inframammary fold, and incision location. Although providing volume recommendations relative to the base width, stretch characteristics, and nipple-to-inframammary fold distance, the system also allows surgeons to add or subtract volume based on specific patient requests, considering possible long-term tissue tradeoffs and consequences.

In conjunction with staged, repetitive patient education and decision-making algorithms, the TEPID system has helped minimize reoperations for size exchange (0.4 percent versus 8.7 percent in premarket application studies) and reduce overall reoperation rates (3 percent versus 17 percent in premarket application studies).[3–8]

For any process to be effective, surgeons must use it. The demands of clinical practice mandate that this process is efficient and comprehensively addresses essential clinical priorities. A comprehensive decision support process must address a wide range of implant types and prioritize the patient's tissues long term. The High Five process prioritizes five decision categories, involves only five measurements and five decisions, and requires less than 5 minutes to perform all measurements and complete clinical planning to optimize patient outcomes.

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