The terms ptosis, mastopexy, breast hypertrophy, and breast reduction encompass a wide range of highly variable levels of breast deformities and surgical processes to address ptosis and hypermastia. For decades, scientific publications and presentations promoting a specific technique have presented decision processes and outcomes analysis based on subjective characterization of the preoperative breast and subjective evaluation of postoperative outcomes. High levels of evidence-based outcomes analysis for these operations have

**Background:** A previous submission defined methods to objectively define nipple position and vertical and horizontal skin excess in mastopexy and breast reduction. This article defines a set of second-stage processes for quantified design and operative planning for skin envelope modification.

**Methods:** A skin envelope modification procedure (periareolar, periareolar plus vertical, or periareolar plus vertical plus horizontal) was selected based on the quantified amount of vertical skin excess. This process was applied in 124 consecutive mastopexy and 122 consecutive breast reduction cases. Average follow-up was 4.6 years (range, 6 to 14 years).

**Results:** All cases were assessed, planned, and executed applying the processes in this article. No patient required nipple repositioning. Complications included excessive lower pole restretch (4 percent), periareolar scar hypertrophy (0.8 percent), hematoma (1.2 percent), and areolar shape irregularities (1.6 percent). Delayed healing at the junction of vertical and horizontal scars occurred in two reduction patients (two of 124 [1.6 percent]), neither of which required revision. The overall reoperation rate was 6.5 percent (16 of 246) for patients in the first 5 years of the study and decreased to 1.6 percent for patients from year 6 through year 14.

**Conclusions:** This study defines processes for using objectively defined parameters for skin envelope modification in mastopexy and breast reduction. Quantifying desired skin envelope design enables surgeons to objectively quantify vertical skin excess and horizontal skin excess, select envelope modification design and techniques based on those parameters, and evaluate outcomes based on objective clinical measurements in both mastopexy and breast reduction. (Plast. Reconstr. Surg. 133: 527, 2014.)

**CLINICAL QUESTION/LEVEL OF EVIDENCE:** Therapeutic, IV.
been limited by a paucity of objectively defined processes and objective data to more scientifically and less subjectively define optimal indications, ranges of efficacy, and outcomes analysis of decision processes and surgical techniques.

Studies in mastopexy and breast reduction based on higher levels of evidence require the following:

1. Objective assessment of preoperative breast dimensions and tissue characteristics using measurements.
2. Objectively defining a desired result using objective measurements.
3. Objectively defined decision processes for technique selection and operative design for breast envelope modification.
4. Objectively defining and adjusting parenchymal volume and position to optimally fill the dimensions of the modified skin envelope.
5. Objective documentation of surgical techniques and breast dimensions created intraoperatively.
6. Objective, serial comparison and evaluation of outcomes using postoperative breast measurements.

A previous study presented an overview of our comprehensive approach to objective, quantified preoperative evaluation, operative planning, technique selection, and outcomes evaluation in mastopexy and breast reduction. That study defined a quantified process to define optimal nipple position, and defined methods to quantify vertical and horizontal skin excess in the breast. This article addresses processes to objectively select and plan envelope modifications in mastopexy and breast reduction. To comply with journal space requirements, a third article will address parenchymal modifications to optimize the amount of fill for the desired dimensions of the modified soft-tissue envelope. These processes have been applied to mastopexy and breast reduction over a 14-year period.

The purpose of this article is not to compare or promote any specific techniques for mastopexy and reduction. This article presents alternative processes that enable surgeons to objectively, not subjectively, characterize the breasts preoperatively; select a preferred technique based on objectively defined parameters; plan and mark the desired dimensions of the soft-tissue envelope; and then objectively document envelope dimension changes during the surgical procedure.

**PATIENTS AND METHODS**

Optimal, natural breast aesthetics exist over a wide range of breast sizes. Optimal aesthetics require a correct and optimal amount of fill for the dimensions (size) of the breast soft-tissue envelope. Optimal outcomes in mastopexy and breast reduction require modifications to the soft-tissue envelope and adjustment of parenchymal fill to optimally fill the modified envelope. Those requirements exist regardless of the technique(s) selected for mastopexy or reduction.

Compared with visual or subjective methods, surgeons can more accurately and objectively define desired breast dimensions for a result in mastopexy and reduction by applying objective measurements preoperatively to a plan that (1) specifies the desired dimensions of the result, (2) designs skin envelope modifications to deliver desired envelope dimensions, and (3) designs parenchymal modifications to optimize the amount of fill for the desired dimensions of the modified soft-tissue envelope.

**Preoperative Measurements**

Preoperative measurements were made by the surgeon on each patient in the study: breast base width, nipple-to-inframammary fold distance measured under maximal stretch, anterior pull skin stretch, soft-tissue pinch thickness of the upper pole, soft-tissue pinch thickness at the inframammary fold, areolar diameter, and sternal notch–to-nipple distance. Aesthetically optimal breast aesthetics requires a nipple-to-inframammary fold distance that is proportionate to the base width of the breast. A range of aesthetically optimal nipple-to-inframammary fold distance relative to base width is established for breast augmentation2–7 (Table 1). These relationships were

| Table 1. Breast Base Width to Nipple-to–Inframammary Fold Relationships for Optimal Aesthetics in Breast Augmentation |
|---|---|---|---|---|---|---|---|---|
| Breast Base Width (cm) | 10.5 | 11.0 | 11.5 | 12.0 | 13.0 | 13.5 | 14.5 | 15.0 |
| Nipple-to-IMF dimension under maximum stretch | 7.0 | 7.0 | 7.5 | 8 | 8 | 8.5 | 9.0 | 9.5 |

IMF, inframammary fold.
simplified and applied in the current study to help define an appropriate nipple-to–inframammary fold distance measured under maximal stretch to set for a specific desired base width when designing skin envelope modification for mastopexy and reduction (Table 2).

Defining Nipple Position, Vertical Skin Excess, and Horizontal Skin Excess

Quantified, objective measurements and methods for defining optimal nipple position and objectively defining vertical and horizontal skin excess are detailed in a previous article.1 Defining nipple position and vertical skin excess is critical to subsequent planning. After defining desired nipple position,1 the surgeon defines a desired areolar diameter to set intraoperatively and then marks the superiormost point of the areola on the breast meridian above the nipple position. The surgeon selects a desired nipple-to–inframammary fold measurement for the result, based on the preoperative base width and desired base width of the result (Table 2), and marks that distance on the breast meridian inferior to the nipple point, defining a point that will be placed at the intersection of the breast meridian with the inframammary fold at closure if the surgeon selects an excision technique in lieu of a redistribution technique. The distance from a point at the intersection of the breast meridian with the inframammary fold to the existing inframammary fold quantifies the vertical skin excess in the breast (Fig. 1).

Preoperative measurements and operative planning decisions were recorded on a clinical assessment and planning form (Fig. 2). This form has evolved during the study, and the current version is available in Microsoft Word (Microsoft Corp., Redmond, Wash.) and in Adobe PDF (Adobe Systems, Inc., San Jose, Calif.) formats and can be modified to individual surgeon preferences.

Alternatives to Address Skin Excess for Envelope Modification

Techniques for breast skin envelope modification commonly used in mastopexy and reduction include (1) redistribution or gathering,9–11 (2) excision,12–17 (3) deepithelialization and imbrication,18,19 (4) skin wounding by various modalities to promote skin contraction, or (5) combinations of these modalities. Whatever modality a surgeon selects, the modality is applied in a specific location and/or over a specific range, both of which can be objectively quantified for objective operative planning and more objective and scientifically valid outcomes analysis. The decision process for selecting a skin envelope modification for mastopexy and reduction was applied according to the algorithm in Figure 3. Each of these processes allows and encourages surgeons to objectively define parameters that better communicate to

<table>
<thead>
<tr>
<th>Base Width (cm)</th>
<th>Proportionate NIMF (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.0–11.5</td>
<td>7</td>
</tr>
<tr>
<td>12.0–13.5</td>
<td>8</td>
</tr>
<tr>
<td>14–16</td>
<td>9</td>
</tr>
<tr>
<td>&gt;16</td>
<td>10</td>
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</tbody>
</table>

NIMF, nipple-to–inframammary fold distance.
Clinical Assessment and Operative Planning for Mastopexy and Breast Reduction

**Preoperative Measurements**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Left</th>
<th>Right</th>
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<tbody>
<tr>
<td>STPTUP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STPTIMF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SN:N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N:IMF_MedStretch</td>
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</table>

**Operative Planning**

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<tbody>
<tr>
<td>AD Desired</td>
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<td></td>
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<tr>
<td>TA: IMF Desired</td>
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<tr>
<td>VSE</td>
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<tr>
<td>HSE</td>
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<td>SN:TA Planned</td>
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**Table for Reference NIMF to Set for Specific BW**

<table>
<thead>
<tr>
<th>Surgeon Can Individualize NIMF to Set for a Specific BW</th>
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</thead>
<tbody>
<tr>
<td>Base Width (cm)</td>
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<tr>
<td>Proportionate NIMF to Set</td>
</tr>
</tbody>
</table>

**Skin Envelope Modification Planning (circle selection and specify dimensions)**

<table>
<thead>
<tr>
<th>VSE Range Criteria to be Individualized by Surgeon</th>
<th>Basic Skin Envelope Modification Design</th>
<th>VSE to Redistribute</th>
<th>Location to Redistribute</th>
<th>VSE to Excise</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSE Range &lt; 3 cm</td>
<td>Periareolar</td>
<td>Cm.</td>
<td>Periareolar Vertical</td>
<td>Cm.</td>
</tr>
<tr>
<td>VSE Range 3-4 cm</td>
<td>Periareolar Plus Vertical</td>
<td>Cm.</td>
<td>Periareolar Vertical</td>
<td>Cm.</td>
</tr>
<tr>
<td>VSE Range &gt; 4 cm</td>
<td>Periareolar Plus Vertical Plus Horizontal</td>
<td>Cm.</td>
<td>Periareolar Vertical</td>
<td>Cm.</td>
</tr>
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**Nipple-Areola Pedicle Planning (circle planned pedicle and specify dimensions)**

<table>
<thead>
<tr>
<th>Specify dimensions from base of pedicle:</th>
<th>Length</th>
<th>Width</th>
<th>Thickness: Proximal</th>
<th>Distal</th>
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**Intraoperative Measurements at Conclusion of Procedure**

<table>
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<tr>
<td>HSE Excised&lt;sub&gt;intra&lt;/sub&gt;</td>
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<tr>
<td>BW</td>
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<tr>
<td>Other:</td>
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</table>

**Fig. 2.** Clinical assessment and operative planning form for skin envelope modification in mastopexy and breast reduction. *STPTUP,* soft-tissue pinch thickness of the upper pole; *STPTIMF,* soft-tissue pinch thickness at the inframammary fold.
colleagues the details of an objective operative plan and enable more objective and scientific analysis of outcomes.

Algorithms for periareolar, periareolar plus vertical, and periareolar plus vertical plus horizontal skin envelope modifications were applied according to the vertical skin excess ranges in Figure 3. Those detailed algorithms are presented graphically and discussed in more detail in the Discussion section of this article. The vertical skin excess range indications for each type of skin envelope modification were defined at the outset and were modified to the current parameters at year 5 of the study. The decision processes do not prioritize surgical techniques, but are designed to enable surgeons to more objectively define, record, and evaluate outcomes of whatever alternatives they choose to address mastopexy and breast reduction. Time required for all measurements and operative planning was recorded for each patient during the surgical consultation.
The objective measurements and objectively defined preoperative plan were precisely transferred to the patient during preoperative marking. Preoperative marking was performed with the patient standing, and anterior pull skin stretch and nipple-to-inframammary fold distance were always measured with the skin under maximal stretch. All markings and measurements were carefully rechecked with the patient supine on the operating table with arms at 90 degrees to the torso. Adjustments to the markings were made as needed to ensure optimal accuracy. No subjective or visually determined markings were made on any patient.

This method was applied in 124 consecutive mastopexy and 122 consecutive breast reduction cases. Average follow-up was 4.6 years (range, 6 to 14 years).

**RESULTS**

Average time to perform all preoperative measurements and operative planning was 12.2 minutes (range, 8.0 to 25.3 minutes) and decreased dramatically as familiarity with the processes evolved. No patient required nipple repositioning. Complications included excessive lower pole restretch (4 percent), periareolar scar hypertrophy (0.8 percent), hematoma (1.2 percent), and areolar shape irregularities (1.6 percent).

Delayed healing at the junction of vertical and horizontal scars occurred in two reduction patients [two of 122 (1.6 percent)], neither of whom required revision. Overall reoperation rate was 6.5 percent (16 of 246) for patients in the first 5 years of the study, and decreased to 1.6 percent for patients from year 6 through year 14. All cases in the series were assessed objectively with measurements that were then used in objectively defined decision processes to select techniques and then objectively design skin envelope modifications.

**DISCUSSION**

The processes described in this article are not intended to promote any specific procedure for mastopexy or breast reduction. Instead, these processes are presented as a framework to encourage surgeon individualization using a more objectively defined framework of measurements and processes for mastopexy and breast reduction. Predictability, reproducibility, accuracy, and efficiency increase when a surgeon can quantifiably define a desired result and, with a minimum of unplanned maneuvers, deliver that result. Artistry can be applied with or without engineering, but if Michelangelo and Leonardo are examples, objective planning can contribute significantly to artistry.

**Periareolar Skin Envelope Modification Planning Processes**

Figure 4 defines the processes for design and marking of cases in which the surgeon has selected a periareolar approach for skin envelope modification. The design of periareolar mastopexy is well described and refined by Spear and colleagues.20,21 In addition to their recommendations, this study records both areolar and outer skin excision diameter and circumference. With ellipsoid outer skin excisions, an accurate measurement or calculation of the circumference of the outer skin excision is an important objective parameter to quantify the degree of stretch placed on the proposed areola and evaluate potential consequences. Quantifying amounts of skin that are excised and/or redistributed allows further analysis of the consequences of those decisions during serial outcomes analysis.

Figure 5 defines processes for design and marking of cases in which the surgeon has selected a periareolar plus vertical approach for skin envelope modification. This algorithm is designed to allow surgeons to modify it to their individual preferences. For example, some surgeons may prefer to stop a vertical excision above the inframammary fold and/or perform suction liposuction in the lower pole of the breast.10 Important variables to quantify are vertical and horizontal skin excess, and the amount of vertical and horizontal skin excess that is either excised or redistributed. All measurements are checked on the operating table, carefully remeasuring each limb individually under maximal stretch, before incising the skin. Measuring with the skin under maximal stretch is essential to ensure consistency and accuracy of measurements in areas where skin compliance varies. After documenting nipple-to-inframammary fold distance measured under maximal stretch during preoperative assessment, it is critically important for surgeons to commit to desired postoperative breast dimensions and define a specific desired nipple-to-inframammary fold distance to establish during the surgical procedure, and to further document where vertical and horizontal skin excess are either redistributed or excised.

Whenever a vertical component exists in a skin envelope modification, surgeons can significantly improve and increase predictability of areolar position and shape by avoiding incorporating
a predesigned areolar skin excision into the top of a Wise pattern or any other pattern. By first closing the vertical limb (and horizontal limb if present), the surgeon has much more flexibility to fine tune areolar position and shape depending on skin tension and laxity at the superior portion of the vertical closure. Closure puts breast skin on stretch, allowing the surgeon to caliper measure the desired nipple-to-inframammary fold distance superiorly from the fold, and ensure that the inferior border of the areola is at that location. That process is more exact when excising both vertical and horizontal skin using an inverted-T incision,
but is also helpful with vertical and periareolar approaches.

Figure 6 defines processes for design and marking of cases in which the surgeon has selected a periareolar plus vertical plus horizontal approach for skin envelope modification. Because more incision length requires more time for closure, efficiency is important to minimize operative
times. The decision and marking process in Figure 6 has dramatically changed every aspect of this author’s approach to breast reduction when patient tissue characteristics and dimensions indicate this approach. For the past decade, designing the operation using these processes has eliminated virtually all visually subjective decisions, and eliminated all tailor tacking, substantially decreasing operative times and improving outcomes by defining quantified dimensions for symmetry instead of relying on less accurate visual observations.

Journal space requirements preclude separate, detailed planning descriptions and illustrations for periareolar, periareolar plus vertical, and periareolar plus vertical plus horizontal skin envelope procedures. The description that follows for periareolar plus vertical plus horizontal skin envelope modification is included to address more difficult cases with greater amounts of vertical skin excess.

After determining optimal nipple position using previously described methods,1 the surgeon marks the planned nipple position on the breast meridian. The surgeon then defines and marks the desired areolar diameter and marks the superior-most point of that areola at the 12-o’clock position and the inferior-most point at the 6-o’clock position. Using the parameters in Table 2 or adjusting those parameters as desired, the surgeon then defines a specific nipple-to–inframammary fold distance to deliver intraoperatively, a distance that is proportionate to the planned base width of the result.

Holding the zero point of a tape measure at the superior-most point on the areola, the surgeon measures a planned nipple-to–inframammary fold distance plus half areolar diameter, a distance that represents the distance from the top of the areola to the inframammary fold at the conclusion of the operation. Holding the tape static at the superior-most point and lifting to put the lower pole skin under maximal stretch, the surgeon marks an arc across the breast using dots and ensuring that the skin is under maximal stretch at every point (Fig. 7). Every point on that arc is located at precisely the desired distance from the top of the areola to the inframammary fold in the planned result. The distance from the point where the inferior-most point on the line from the superior-most point of that areola at the 12-o’clock position to the desired inframammary fold on the breast meridian to the point where the meridian intersects the inframammary fold at the midpoint represents the vertical skin excess in the breast (Fig. 8).

When the vertical skin excess exceeds 4 cm according to the algorithm in Table 3 (surgeons can modify ranges to their preferences), the surgeon plans horizontal excision of the vertical skin excess using a modified Wise pattern with no premarked skin excision at the proposed, new areola inset site. Early in this study, by comparing the vertical skin excess to lengths of the inframammary fold scar, it became apparent that in over 95 percent of cases, excess vertical skin can be excised from the lower pole using a 1:2 ratio of vertical-to-horizontal dimension, where the vertical skin excess is the vertical dimension for excision, and two times the vertical skin excess is the horizontal dimension along the inframammary fold.

To precisely mark incisions for skin envelope modification, the surgeon begins at the midpoint on the meridian at the inframammary fold, and marks a distance equal to the vertical skin excess on the inframammary fold lateral and medial to the midpoint (Fig. 9) that defines the medial and lateral extents of the inframammary fold incision. Next, the surgeon places the zero point of the tape measure at the lateral inframammary fold point, holds that point stable with the one hand, then positions the thumb and forefinger at a distance slightly greater than the vertical skin excess on the tape and swings the tape superiority until the vertical skin excess distance on the tape intersects a point on the previously drawn arc and marks the inferior-most point of the lateral vertical limb of the keyhole (Fig. 10). The surgeon repeats similar marking on the medial side, and then connects the superior-most point of the areola (SA, Fig. 11, left) with the inferior-most point of the vertical limb of the keyhole (Fig. 11, VL̄ lateral). Next, the surgeon draws a line that connects the inferior-most point of the lateral vertical limb (Fig. 11, VL̄ lateral) to the lateralmost extent of the inframammary fold (Fig. 11, point IMF lateral right). Finally, the surgeon repeats those same markings on the medial side of the breast to establish quantified parameters for skin envelope modification. Finally, the surgeon measures and records the horizontal skin excess, the maximum horizontal skin excision measured between the widest points of the vertical incision limbs (Fig. 12).

Using this approach, the length of the inferior borders of the medial and lateral flaps exactly matches the length of the inframammary fold incision. No tailoring or dog-ear removal is ever necessary if measurements and design are correct and if all measurements are performed under maximum stretch. The lengths of the vertical limbs medially exactly match if measured under equal stretch during marking. The width of the keyhole at its widest point (that defines the horizontal skin excess) is determined by the
Fig. 6. Decision processes and preoperative marking for periareolar plus vertical plus horizontal skin envelope modification in mastopexy and breast reduction.
relationship of the vertical skin excess to the superiormost point at the planned 12-o’clock position to the inframammary fold. For example, the wider the breast, the longer the superiormost point at the planned 12-o’clock position to the inframammary fold should be. The position of the arc at that distance and the individualized vertical skin excess remaining below it in that breast determine the intersection point of the vertical skin excess from the lateral point on the inframammary fold to the inferiormost point of the lateral vertical limb on the arc.

When the length of the inframammary fold is less than two times the vertical skin excess, or stated alternatively, when two times the vertical skin excess exceeds the length of the inframammary fold, to avoid an excessively long inframammary fold incision, the surgeon can alternatively redistribute a portion of the vertical skin excess into the vertical and/or periareolar incisions and document the site and amount of redistribution. (See Video, Supplemental Digital Content 1, which demonstrates quantified nipple positioning and skin envelope modification for mastopexy.

![Fig. 7](image_url)

*Fig. 7.* The surgeon defines the desired superiormost areolar point–to–inframammary fold distance (SA:IMF\textsubscript{planned}) depending on the base width of the breast and the diameter of the areola, and then from superiormost point of the areola under maximal stretch at each measurement, places an arc of dots across the breast. SA, superiormost areolar point.

![Fig. 8](image_url)

*Fig. 8.* The distance from the point where the inferiormost point on the line from the superiormost point of that areola at the 12-o’clock position to the desired inframammary fold on the breast meridian (M) to the point where the meridian intersects the inframammary fold at point M represents the vertical skin excess (VSE) in the breast.
After marking the patient standing with her hands on her hips, it is important to recheck all measurements with the patient supine on the operating table and when placing each segment to measure under maximal stretch. It is also important to recheck nipple position and compare to any other method a surgeon chooses, and check standard pinch test approximations to preclude an error in design causing excess skin removal. Surgeons who are more familiar with tailor tacking techniques may easily make the markings as described here, and then use the technique with which they are most familiar but still take objective measurements before skin excision. If the surgeon uses a subcuticular skin closure, precise caliper measurement after closure should indicate slight shortening of each closure segment compared with preoperative measurements because the subcuticular suture decreases skin tension along the line of closure. This approach to breast modification prioritizes design of the specific dimensions of the desired result, designing an objective, quantified skin envelope modification to deliver the desired

**Fig. 9.** The surgeon marks the lateral extent of the inframammary fold incision (IMF<sub>Lateral</sub>) at a distance equal to the vertical skin excess (VSE) lateral to point M on the inframammary fold.

**Fig. 10.** The surgeon places the zero point of the tape measure at the lateral inframammary fold point (IMF<sub>Lateral</sub>), holds that point stable with the one hand, then positions the thumb and forefinger at a distance slightly greater than the vertical skin excess (VSE) on the tape and swings the tape superiority until the vertical skin excess distance on the tape intersects a point on the previously drawn arc and marks the inferiormost point of the lateral vertical limb of the keyhole (VL<sub>Lateral</sub>).
dimensions, and then designing the amount and location of breast parenchyma for optimal fill of the modified envelope.

The importance of the nipple-to–inframammary fold dimension in all breast surgery cannot be overemphasized. That critical dimension affects nipple position, nipple tilt, visual relationships of the nipple to the inframammary fold, and subjective judgments that may label a breast “boxy” (nipple-to–inframammary fold too short relative to base width) or “bottomed-out” (nipple-to–inframammary fold too long relative to base width). Nipple-to–inframammary fold dimension also affects the position of an inframammary fold scar (a nipple-to–inframammary fold distance that is too short pulls the scar superiorly out of the existing fold) and, when too short, can also induce pressure that can displace inferior pole parenchyma below the inframammary fold.

The Regnault classification of ptosis has been invaluable to five decades of surgeons, but it is
a visually determined and therefore subjective system that has two substantial limitations: first, with no strictly objective measurements, a range of surgeons are more likely to have differing assessments of the degree of ptosis in any given patient; and second, most importantly, the classification does not quantify or take into account the quantity of parenchyma in a breast for a given nipple-to–inframammary fold length. Using the system, a substantial number of breasts are classified as ptotic, implying a need for mastopexy, when in fact the relationship of nipple-to–inframammary fold to base width is entirely normal, and simply filling the existing envelope is all that is required. One simple measurement of nipple-to–inframammary fold distance measured under maximal stretch is an invaluable addition to the Regnault system. If the nipple-to–inframammary fold distance measured under maximal stretch is less than 9.5 or 10 cm, breast aesthetics can be optimized by volume increase alone without skin envelope modification in a majority of cases. The nipple-to–inframammary fold dimension is critical to optimal planning in any aesthetic breast procedure and should be measured as described previously.²,³

A higher level of objectivity in patient assessment, technique selection, operative planning, surgical technique, and serial analysis of long-term outcomes offers substantial opportunities to improve outcomes in mastopexy and breast reduction. Increased objectivity in each of these processes offers an opportunity to implement and improve key processes by:

- More accurately and objectively quantifying the preoperative breast characteristics, enabling quantified planning and definition of a desired postoperative result.
- More objectively defining ranges of efficacy for each procedure to enable surgeons to select an approach that is most likely to predictably deliver a higher level of outcome with less risk of complications and reoperations while delivering optimal long-term outcomes.
- More objectively defining the detailed processes of decision making that are key to optimal technique selection and by identifying portions of techniques that are ineffective, thereby increasing efficiency in the operating room and reducing anesthetic times and surgical trauma.
- Enabling a more objective approach to operative planning and technique selection that limits the gray areas inherent in any subjective analysis or plan, thereby increasing accuracy, efficiency, and efficacy.
- Enabling surgeons to discuss and share objectively based processes, using numbers in addition to pictures and subjective terminology.
- Dramatically shortening the learning curve by providing objectively derived, highly defined, and highly reproducible processes and efficacy limits that can enable surgeons to deliver higher levels of outcomes to more patients earlier in the surgeon’s career.

Video. Supplemental Digital Content 1 demonstrates quantified nipple positioning and skin envelope modification for mastopexy and breast reduction, available in the “Related Videos” section of the full-text article on PRSJournal.com or, for Ovid users, available at http://links.lww.com/PRS/A940.
Objectively defining a surgical goal is requisite to an objective assessment of the degree to which that goal is met both short and long term. Preoperatively and postoperatively, every breast has dimensions that can be defined by simple, objective measurements that require only a tape measure and caliper. Incorporating even the simplest objective measurements into defined processes has dramatically impacted the predictability and quality of the patient experience and outcomes in breast augmentation. Mastopexy and breast reduction embody several common principles with breast augmentation. Optimal outcomes require an appropriate amount of fill for the dimensions of the skin envelope, optimal nipple location on the breast mound, and an appropriate relationship between base width and nipple-to-inframammary fold distance. Those parameters can be quantified for mastopexy and breast reduction using processes similar to those developed for breast augmentation.

Many factors influence a surgeon’s preference for a specific technique in mastopexy or reduction. Preferences may change as a surgeon gains experience with one or more techniques. Every technique has a range of efficacy. Although that range may increase with surgeon experience, specific patient tissue characteristics limit the range, regardless of a surgeon’s expertise with a procedure. Objectively defining the range of efficacy of a technique potentially offers substantial benefits to patients and surgeons by shortening a surgeon’s learning curve, increasing the quality of outcomes earlier in a surgeon’s experience, and increasing the transferability of the critical factors in a process that optimize outcomes.

**CONCLUSIONS**

1. Preoperative planning and technique selection for mastopexy and reduction can be objectively quantified, and preoperative planning and marking can be based on objective measurements.

2. This study defines methods that enable surgeons to apply objectively defined vertical and horizontal skin excess measurements to the objective planning of skin envelope modification, excess skin redistribution or excision, and objective evaluation of long-term outcomes in mastopexy and breast reduction.

3. Following our previous publication that defined objective measurement methods to define optimal nipple position and vertical and horizontal skin excess for mastopexy and reduction, this article presents objective, quantifiable methods to address the second critical component of the breast, the skin envelope. A third submission will address quantifiable methods for assessment, planning, and outcomes evaluation for the parenchymal component of the breast.

4. Whether a surgeon chooses to redistribute excess skin into areas of the breast envelope or chooses to excise excess skin, surgeons can quantify the amounts and specific areas for skin envelope modifications.

5. Quantified decision methods, operative planning, and preoperative marking produce objective data that, compared with subjectively derived parameters, provide an opportunity for surgeons to more objectively and scientifically plan and evaluate different mastopexy and breast reduction techniques, more effectively address the requirements of evidence-based medicine, and offer opportunities to shorten the learning curves by providing more objectively defined alternative processes for these challenging procedures.

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**REFERENCES**


