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ORIGINAL ARTICLE
Cosmetic

A Comparison of 28 Published Augmentation/Mastopexy Techniques Using Photographic Measurements

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Background: Numerous augmentation/mastopexy methods have been described in the literature, including those reported in 16 publications in 2019. However, objective measurements of breast dimensions are lacking, leaving little information on which to base treatment selection. The goal is to increase upper pole projection using an implant and correct ptosis by elevating the lower pole with the mastopexy.
Methods: A PubMed search was conducted to identify published augmentation/mastopexy methods. Lateral photographs were matched for size and orientation and then compared using a 2-dimensional measurement system. Measurements were compared for 5 common approaches—vertical; periareolar; inverted-T, central mound; inverted-T, superior pedicle; and inverted-T, inferior pedicle. Four publications not fitting these 5 groups were also evaluated. Measurement parameters included breast projection, upper pole projection, lower pole level, breast mound elevation, nipple level, area, and breast parenchymal ratio.
Results: A total of 106 publications were identified; 32 publications included lateral photographs suitable for comparison. Twenty-eight publications fitting 1 of the 5 groups were compared. All published augmentation/mastopexy methods increased breast projection and upper pole projection, although not significantly for inverted-T methods. Vertical augmentation/mastopexy was the only method that significantly raised the lower pole level ($P < 0.05$). The vertical technique also significantly ($P < 0.01$) increased the breast parenchymal ratio. Periareolar; inverted-T, central mound; and inverted-T, inferior pedicle methods produced nonsignificant increments in the breast parenchymal ratio.
Conclusions: Breast implants increase breast projection and upper pole projection. Only vertical augmentation/mastopexy significantly elevates the lower pole. This method also significantly increases the breast parenchymal ratio, achieving the surgical objectives. *(Plast Reconstr Surg Glob Open 2020;8:e3092; doi: 10.1097/GOX.0000000000003092; Published online 21 September 2020.)*

INTRODUCTION

Numerous publications describe augmentation/mastopexy. This procedural combination is the subject of a dramatic increase in surgeons' interest. In 2019, 16 methods were published.[1–16] However, a lack of objective information makes it difficult to compare techniques. A major limitation in evaluating methods is a lack of measurements. Without measurements, there is no objective means to evaluate results. Complication and reoperation rates are of limited value because they are heavily influenced by the surgeon's definition of a complication and threshold for recommending a reoperation.[17]

To compare the existing methods, standardized photographs and measurements are needed.[18] To this end, the author introduced a 2-dimensional measurement system[18] and has used this system to evaluate published mastopexy and reduction methods.[19] An advantage of this system is that it can be applied to published photographs, which are matched using computer assistance.[19]

This retrospective study was undertaken to compare published methods and to assess their performance. The information presented in this study may guide plastic surgeons and patients in selecting an optimal surgical method.

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Received for publication May 19, 2020; accepted June 22, 2020.

DOI: 10.1097/GOX.0000000000003092

Disclosure: *Dr Swanson receives royalties from Springer Nature (Cham, Switzerland). The author received no financial support for the research, authorship, and publication of this article.*

MATERIALS AND METHODS

Publications

A Pubmed search was performed using the keywords "mastopexy" and "augmentation." All articles published in English were included, starting in 1979 and ending in 2019. Additional studies that did not contain these key words but described augmentation/mastopexy were also accessed.

In articles with more than one set of before-and-after photographs, the first set of images was used. In many cases, lateral photographs were unavailable or were rotated. Lateral photographs are essential for studying changes in the breast morphology. Oblique photographs may be visually appealing, but are not useful for measurements because of varying degrees of rotation.[19]

Measurements

Lateral photographs were compared. In almost all studies, the published photographs were not standardized. The before-and-after photographs frequently differed in magnification and tilt. The Canfield 7.4.1 Mirror imaging system (Canfield Scientific, Fairfield, N.J.) was used to match the photographs for size and orientation. A 32.5-cm upper arm length was used for calibration, which represents the average woman's upper arm length.[20] The use of such a reference length is justified because the difference between preoperative and postoperative values is being studied. As long as the calibration remains consistent for preoperative and postoperative images, the statistical significance of differences and ratios is unaffected.[19]

Measured dimensions included breast projection, upper pole projection, lower pole level, breast mound elevation, nipple level, area, and breast parenchymal ratio.[18] The sternal notch was used as a fixed landmark. This level is typically ascertained from the frontal images. Even if this plane is marked a little high or a little low, it will remain at the same level for both preoperative and postoperative measurements, ensuring the reliability of comparisons.[18] The inframammary fold is not used in this system. This landmark is frequently hidden in women with glandular ptosis.[18] Breast mound elevation represents the vertical change in the level of the breast apex. Area measurements were made using the area measurement function of the Canfield 7.4.1 Mirror system.[18] Dividing the upper pole area by the lower pole area provided the breast parenchymal ratio, a measure of breast "perkiness."[18] Higher ratios (ie, ≥1.5) are considered to be more desirable than lower ratios.[18]

Unlike the qualitative Regnault classification,[21] this system does not conflate nipple position with glandular ptosis, and allows quantitative analysis. The area measurement is a useful surrogate for volume.[18] Volume varies as the square of differences in area. For example, a 20% increase in area represents a 44% increase (1.20 × 1.20) in volume. There is no need to define the chest wall/breast interface because the chest component cancels out when comparing matched lateral images.[18] The nipple level is measured vertically from the level of the breast apex. Ideally, the nipple is located at the point of maximum breast projection.[18,20]

Comparisons

When possible, publications with suitable photographs for measurements[8–13,15,16,22–45] were categorized into 5 groups: vertical[13,29,31,33,40,44]; periareolar[8,23–25,28,30,39]; inverted-T, central mound[9,10,12,15,34,36,41,43]; inverted-T, superior or superomedial pedicle[11,32,42]; and inverted-T, inferior pedicle.[27,35,37,38] An "all procedures" group was included (Tables 1 and 2). The same groups were previously compared for women undergoing mammaplasties without simultaneous implants, with the exception of the inframammary (no-vertical-scar) method,[19] which was not selected by any of the authors.

Statistical Analysis

Statistical analyses were conducted using IBM SPSS for Mac version 26.0 (SPSS, IBM Corp. Armonk, NY). Paired

Table 1. Patient Data

Procedure	Age (y)	Follow-up Time (mo)	Implant Volume (mL)
Vertical (n = 6)			
Mean	35.8	16.8	276.0
SD	4.8	12.0	57.2
Range	30–41	6–34	225–345
Periareolar (n = 7)			
Mean	38.6	9.9	312.5
SD	8.1	8.3	60.6
Range	28–51	1–24	255–390
Inverted-T, central mound (n = 8)			
Mean	40.1	15.9	332.1
SD	6.6	9.4	118.8
Range	34–52	9–36	240–575
Inverted-T, superior pedicle (n = 3)			
Mean	38.0	26.0	335.0
SD	2.8	19.8	14.1
Range	36–40	12–40	325–345
Inverted-T, inferior pedicle (n = 4)			
Mean	36.3	5.8	241.7
SD	7.1	4.6	142.2
Range	30–44	1–12	125–400
All procedures (n = 28)			
Mean	38.2	13.4	302.4
SD	6.4	10.5	92.9
Range	28–52	1–40	125–575

Table 2. Difference in Breast Measurements (Postoperative minus Preoperative)

Measurement	Procedure	Mean*	SD	P†	P‡
Breast projection (cm)	Vertical ($n = 6$)	+2.13	1.55	< 0.05	
	Periareolar ($n = 7$)	+2.01	0.65	< 0.001	
	Inverted-T central mound ($n = 8$)	+1.57	1.01	< 0.05	
	Inverted-T superior pedicle ($n = 3$)	+2.57	0.80	< 0.05	
	Inverted-T inferior pedicle ($n = 4$)	+2.00	1.75	NS	
	All procedures ($n = 28$)	+1.97	1.13	< 0.001	NS
Upper pole projection (cm)	Vertical ($n = 6$)	+1.67	1.07	< 0.05	
	Periareolar ($n = 7$)	+2.18	1.12	< 0.05	
	Inverted-T central mound ($n = 8$)	+0.92	1.32	NS	
	Inverted-T superior pedicle ($n = 3$)	+1.50	0.93	NS	
	Inverted-T inferior pedicle ($n = 4$)	+1.11	1.13	NS	
	All procedures ($n = 28$)	+1.49	1.18	< 0.001	NS
Lower pole level (cm)	Vertical ($n = 6$)	−2.06	1.39	< 0.05	
	Periareolar (n = 7)	−1.04	1.75	NS	
	Inverted-T central mound ($n = 8$)	−0.51	1.62	NS	
	Inverted-T superior pedicle ($n = 3$)	−1.78	1.28	NS	
	Inverted-T inferior pedicle ($n = 4$)	−0.27	1.48	NS	
	All procedures ($n = 28$)	−1.08	1.59	= 0.001	NS
Breast mound elevation (cm)	Vertical ($n = 6$)	+3.56	1.59	< 0.01	
	Periareolar (n = 7)	+2.74	1.78	< 0.01	
	Inverted-T central mound ($n = 8$)	+2.70	2.24	< 0.05	
	Inverted-T superior pedicle ($n = 3$)	+4.37	1.12	< 0.05	
	Inverted-T inferior pedicle ($n = 4$)	+2.95	0.67	< 0.01	
	All procedures ($n = 28$)	+3.11	1.71	< 0.001	NS
Nipple level (cm)	Vertical ($n = 6$)	−5.11	1.84	= 0.001	
	Periareolar (n = 7)	−3.42	2.16	< 0.01	
	Inverted-T central mound ($n = 8$)	−4.18	1.25	< 0.001	
	Inverted-T superior pedicle ($n = 3$)	−4.54	1.56	< 0.05	
	Inverted-T inferior pedicle ($n = 4$)	−3.18	1.74	< 0.05	
	All procedures ($n = 28$)	−4.09	1.75	< 0.001	NS
Area (%)	Vertical ($n = 6$)	+13.86%	14.94%	< 0.05	
	Periareolar ($n = 7$)	+23.33%	19.15%	< 0.05	
	Inverted-T central mound ($n = 8$)	+12.51%	14.37%	< 0.05	
	Inverted-T superior pedicle ($n = 3$)	+10.00%	2.12%	< 0.05	
	Inverted-T inferior pedicle ($n = 4$)	+19.09%	27.59%	NS	
	All procedures ($n = 28$)	+15.32%	19.13%	< 0.001	NS
Breast parenchymal ratio	Vertical ($n = 6$)	+0.72	0.32	< 0.01	
	Periareolar ($n = 7$)	+0.18	0.13	NS	
	Inverted-T central mound ($n = 8$)	+0.26	0.33	NS	
	Inverted-T superior pedicle ($n = 3$)	+0.48	0.12	< 0.05	
	Inverted-T inferior pedicle ($n = 4$)	+0.27	0.44	NS	
	All procedures ($n = 28$)	+0.43	0.34	< 0.001	NS

*Negative values indicate elevation for lower pole level and nipple level.
†Differences between preoperative and postoperative measurements were compared using paired *t* tests.
‡Comparisons of change scores (postoperative minus preoperative) between procedure groups were computed using one-way analyses of variance.
NS, not significant.

t tests were used to compare preoperative and postoperative measurements. One-way analysis of variance was used to compare means between groups. A *p* value of less than 0.05 was considered significant.

RESULTS

A total of 106 publications were identified from the PubMed search.[1–16,22–111] Publications describing secondary augmentation/mastopexy were not considered.[97–101] Viewpoints and letters to the editor that did not contain before-and-after photographs could not be evaluated.[102–104] Publications that did not include lateral images of augmentation/mastopexy[1–7,14,46–93,100] and publications with overly cropped photographs[93–96] were also excluded, leaving 32 studies with suitable photographs for evaluation.[8–13,15,16,22–45] Four studies[16,22,26,45] used methods that did not fit into 1 of the 5 groups and were therefore excluded from comparisons.

The mean age among study patients was 38 years. The mean follow-up time was 13 months. The mean implant volume was 302 mL. There were no significant differences in mean age, follow-up time, or implant volume between groups (Table 1). Among the 32 studies with photographs that were available for analysis, the implant pocket was subpectoral (or dual plane) in 28 publications (87.5%),[9–13,15,16,22–29,31–40,43–45] and subglandular in 3 studies (9.4%).[8,30,42] The pocket location was not described in 1 study (3.1%).[41]

Investigators reported using silicone gel implants in 22 women and saline implants in 6 women. The implant type was not reported in 4 studies. The implant was reported as round in 24 studies and as shaped in 2 studies. The shape was not provided in 6 studies. In 9 studies the surface was reported as smooth; in 7 studies a textured implant was specified. In 16 studies the surface characteristic was unreported. Two studies reported using high-profile implants.

Figures 1–5 demonstrate examples of each of the 5 augmentation/mastopexy methods. Figures 6–10 illustrate the differences in mean breast measurements for the 5 methods, facilitating visual comparisons.

All 5 techniques increased breast projection and upper pole projection (Table 2, Figs. 6–10). However, the increment in upper pole projection was not significant for inverted-T methods. Vertical mastopexy was most effective in raising the lower pole level, with an average elevation of 2.1 cm, the only method to achieve a significant difference

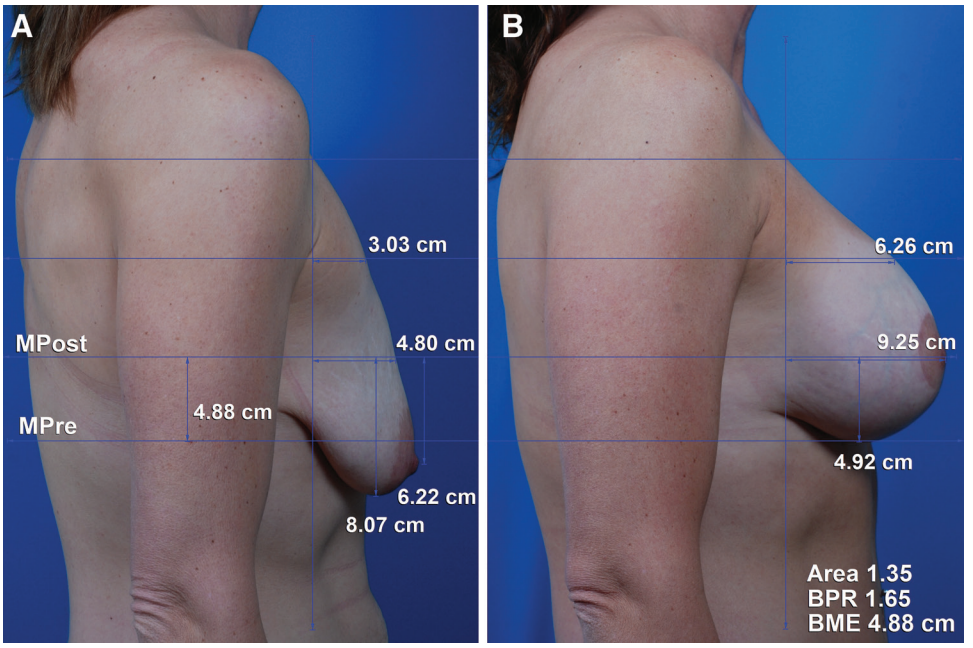

Fig. 1. This 41-year-old woman is shown before (A) and 13 months after (B) a vertical augmentation/mastopexy using a medial pedicle. She received 330 mL smooth, round Mentor (Mentor Corp., Irvine, Calif.) subpectoral saline breast implants. Breast projection is increased by 4.5 cm and upper pole projection is increased by 3.2 cm. The lower pole level is elevated by 3.2 cm and the breast mound is elevated by 4.9 cm (BME). The nipple level is raised by 6.2 cm. Breast area is increased by 35%. The postoperative breast parenchymal ratio (BPR) is 1.65, increased from 0.80 preoperatively. Images are matched for size and orientation. *MPre*, plane of maximum preoperative breast projection. *MPost*, plane of maximum postoperative breast projection. Adapted with permission from *Plast Reconstr Surg Glob Open*. 2016;4:e1170.[40]

($P < 0.05$). The inverted-T, inferior pedicle technique was the least effective in elevating the lower pole, with a nonsignificant mean elevation of 0.3 cm (Fig. 10). Breast area and the breast parenchymal ratio were increased by all methods. The vertical technique significantly ($P < 0.01$) increased the breast parenchymal ratio, from a mean ratio of 1.16 preoperatively to 1.88 postoperatively, for an increase of 0.72. Periareolar; inverted-T, central mound; and inverted-T, inferior pedicle methods produced nonsignificant increments in the breast parenchymal ratio (+0.18, +0.26, and +0.27 respectively).

Two new methods, published within the last year,[16,45] and 2 older publications describing the crescent augmentation/mastopexy[26] and the original "minus-plus" concept[22] were also evaluated.

DISCUSSION

Augmentation/mastopexy is the subject of intense interest among plastic surgeons today. Over 100 mastopexy methods (without implants) have been described.[19] A similar number of augmentation/mastopexy methods have now been published. Women seeking augmentation/mastopexy typically desire a greater upper pole volume and elevation of their breasts.[40,106] Mastopexy alone is often disappointing in terms of restoring the upper pole volume. Rigorous measurements on standardized photographs reveal that "auto-augmentation" methods and fascial suspension sutures are ineffective.[19] Regnault et al,[22] in 1988, recognized the need for a breast implant to restore the upper pole volume, and lower-pole reduction to correct sagging—the minus-plus principle.

Vertical Augmentation/Mastopexy

The vertical method tightens and reduces the lower pole, where there is typically redundant skin and breast tissue (Fig. 1).[19,112] This operation has several geometric advantages over nonvertical methods.[19] It is the only mastopexy method that effectively elevates the inframammary fold.[14,108] The horizontal scar is either minimized or avoided altogether. There is no skin undermining. Nipple overelevation may be avoided.[19,107,109] Vertical mammaplasty requires less operating time than the Wise pattern and offers a high degree of safety because the superficial pedicle (wholly located anterior to the breast implant rather than tethered at the inframammary fold) is short and robust.[106,110] A medial or superomedial dermal connection is preserved.[14,40,106] Consequently, the vertical method is well-suited and safe for combined surgery with breast implants.[40,106,110] Using the vertical approach, the 2 objectives—upper pole volume enhancement and correction of lower pole excess—are in fact synergistic,[40,106] not competing as often described.[9] Surveys reveal a patient preference for the vertical method over the Wise pattern.[113]

Measurements demonstrate that vertical augmentation/mastopexy provides a boost in upper pole

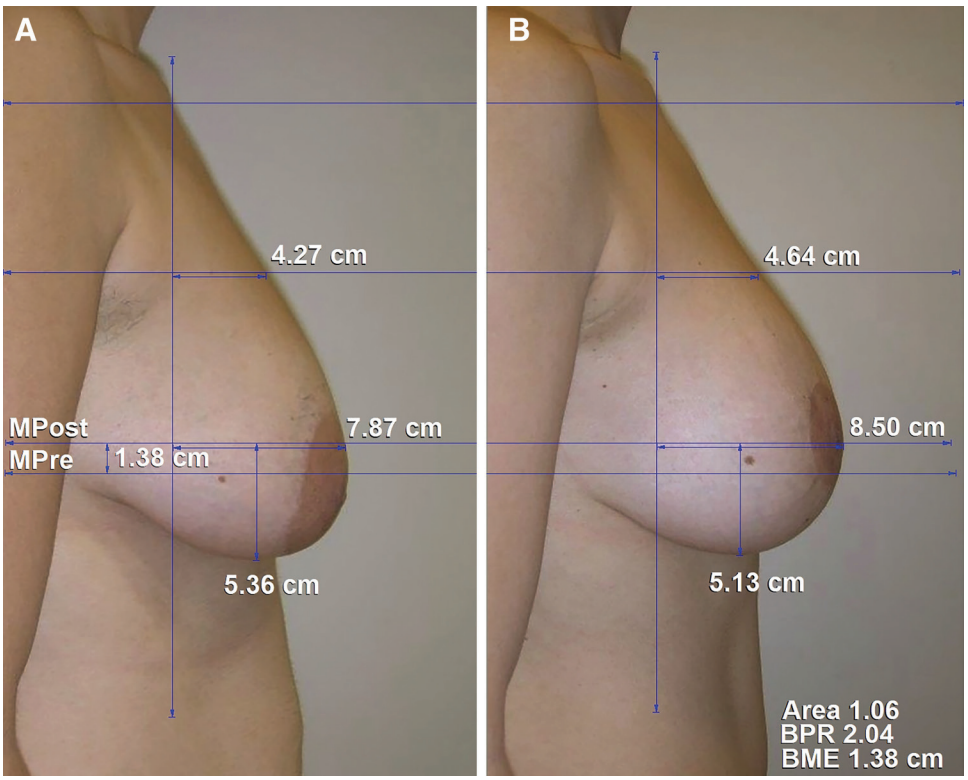

Fig. 2. This 32-year-old woman is shown before (A) and 17 months after (B) a periareolar augmentation/mastopexy using 330 mL smooth, round subglandular silicone gel implants. Breast projection is increased by 0.6 cm and upper pole projection is increased by 0.4 cm. The lower pole level is elevated by 0.2 cm and the breast mound is elevated by 1.4 cm (BME). Breast area is increased 6%. The postoperative breast parenchymal ratio (BPR) is 2.04, compared with 1.78 preoperatively (+0.26). Images are matched for size and orientation. *MPre*, plane of maximum preoperative breast projection. *MPost*, plane of maximum postoperative breast projection. Adapted with permission from *Aesthet Surg J*. 2019;39:953–965.[8]

projection and breast projection (Table 2, Figs. 1, 6), as expected from breast implants. Vertical mastopexy cinches and raises the lower pole, sufficient to overcome the lower pole-lowering effect of the implant.[107] Staging is unnecessary.[40,106]

Periareolar Augmentation/Mastopexy

A periareolar mastopexy (Figs. 2, 7) is often recommended for women with mild degrees of ptosis or nipple asymmetry and little skin redundancy.[88] The Benelli method,[114] which includes a substantial parenchymal dissection, gained popularity 3 decades ago. However, this method was largely abandoned by plastic surgeons as its limitations became recognized, including frequent areola distortion.[111,115]

In an effort to avoid a vertical scar, the tissue resection is directed to the breast apex, almost exactly in line with the expanding skin envelope.[106] Increased periareolar tension often causes wound healing problems and can flatten the areola, creating an unnatural operated-on appearance,[111] which is not prevented by permanent "blocking" sutures.

Lower pole elevation may be minimal (Fig. 2) because there is no lower pole parenchymal or skin resection. In this study, the mean lower pole elevation after periareolar augmentation/mastopexy was 1.0 cm, similar to the findings of a previous study evaluating periareolar mastopexy without implants (0.8 cm).[19] The periareolar method provided the least gain in the breast parenchymal ratio among the 5 methods studied (+ 0.18, not significant).

Inverted-T, Central Mound Augmentation/Mastopexy

The tissue-based triad[36] has received recent attention in the literature.[9] A central mound technique is combined with an inverted-T skin closure. The decision to perform a mastopexy with implants is determined by skin stretch, comparing the nipple-to-inframammary fold length on stretch with the desired nipple-to-inframammary fold length.[9,36] Staged surgery is recommended for women with greater than 6 cm of vertical skin excess.[9] The rationale for a 6-cm benchmark is unclear. Women with greater skin laxity make even better candidates for single-stage surgery; the breast implant and lower pole skin resection work together to take up the slack.[40] The horizontal incision is twice as long as the vertical skin excess.[9] This method, therefore, cannot be considered a short scar technique. The breast implant provides a boost in breast projection and upper pole projection, as expected. The lower pole level is raised by only 0.3 cm (Fig. 3).

The mean lower pole elevation using the inverted-T, central mound method averaged 0.5 cm (Fig. 8), with little

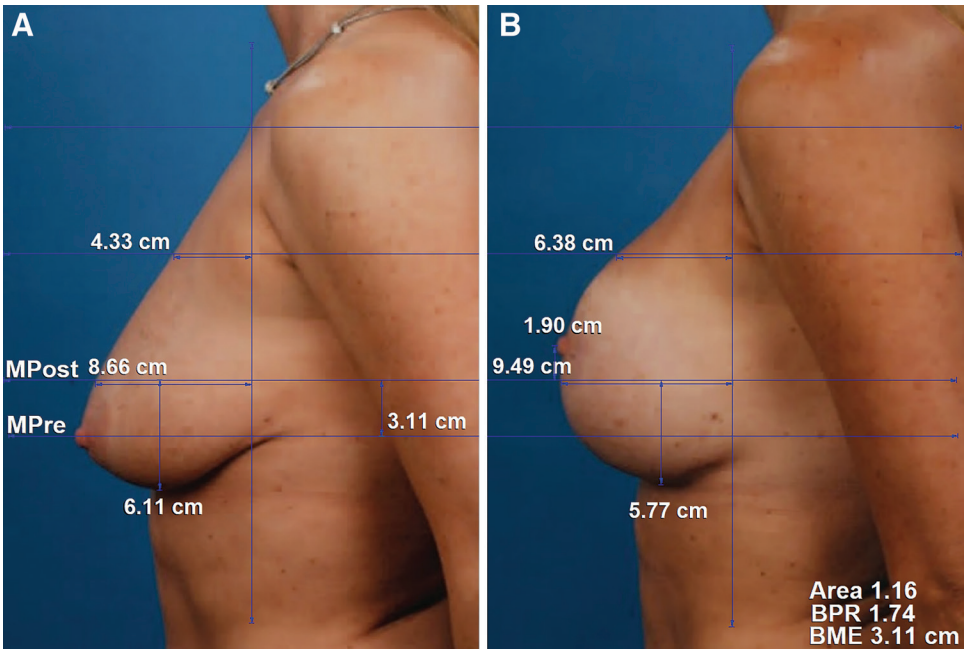

Fig. 3. This 46-year-old woman is shown before (A) and 1 year after (B) an inverted-T, central mound augmentation/mastopexy using 270 mL smooth, round subpectoral silicone gel implants. Breast projection is increased by 0.8 cm and upper pole projection is increased by 2.1 cm. The lower pole level is elevated by 0.3 cm and the breast mound is elevated by 3.1 cm (BME). The nipple is overelevated by 1.9 cm. Breast area is increased 16%. The postoperative breast parenchymal ratio (BPR) is 1.74, compared with 1.22 preoperatively. Images are matched for size and orientation. *MPre*, plane of maximum preoperative breast projection. *MPost*, plane of maximum postoperative breast projection. Adapted with permission from *Aesthet Surg J*. 2014;34:723–732.[36]

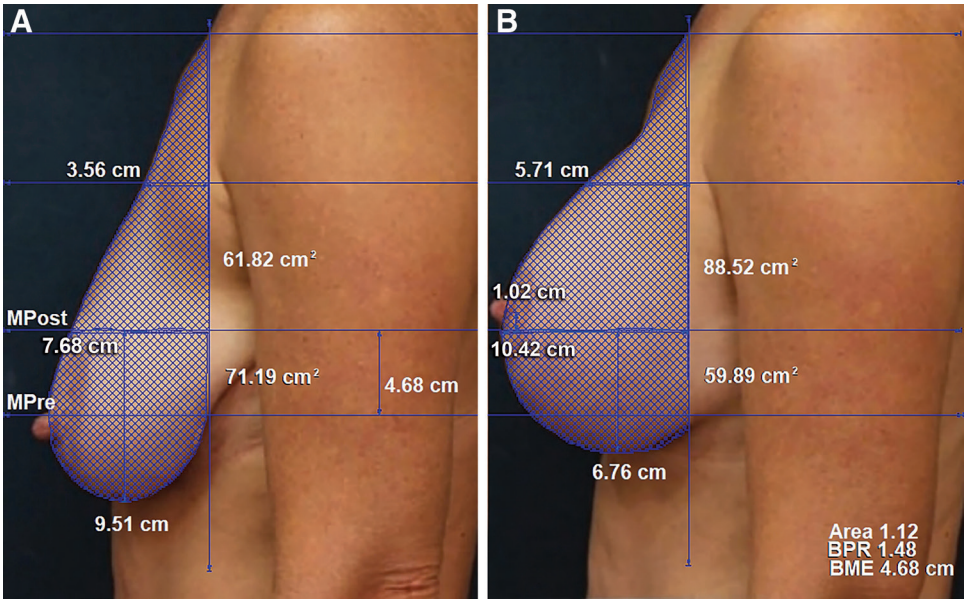

Fig. 4. This 40-year-old woman is shown before (A) and 12 months after (B) an inverted-T, superomedial pedicle augmentation/mastopexy using 345 mL smooth, round subpectoral silicone gel implants. Breast projection is increased by 2.7 cm and upper pole projection is increased by 2.2 cm. The lower pole level is elevated by 2.8 cm and the breast mound is elevated by 4.7 cm (BME). The nipple is overelevated by 1.0 cm. Breast area is increased by 12%. The postoperative breast parenchymal ratio is 1.48, compared with 0.87 preoperatively (61.82 cm^2/71.19 cm^2). These photographs include demonstration of the area calculations, comparing the upper and lower pole areas, divided at the level of maximum postoperative breast projection (MPost). Images are matched for size and orientation. *MPre*, plane of maximum preoperative breast projection. Adapted with permission from *Aesthet Surg J*. 2019;39:1352–1367.[11]

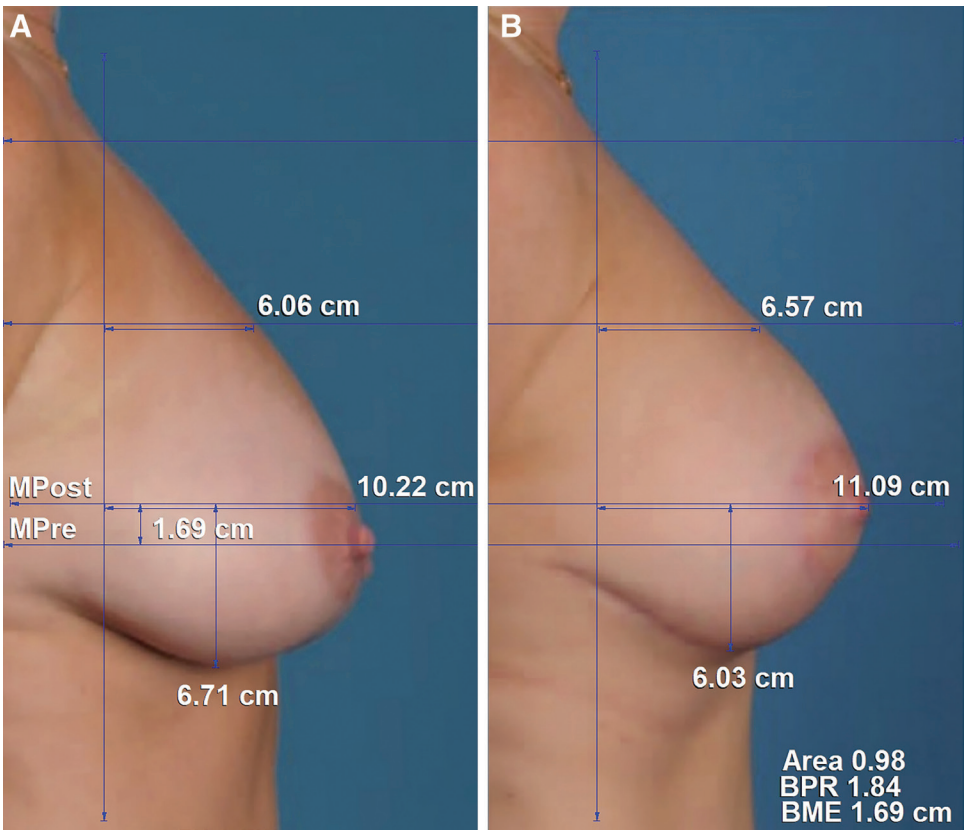

Fig. 5. This 44-year-old woman is shown before (A) and 6 months after (B) an inverted-T, inferior pedicle augmentation/mastopexy using 125 mL saline, round subpectoral implants. Breast projection is increased 0.9 cm and upper pole projection is increased 0.5 cm. The lower pole level is elevated by 0.7 cm and the breast mound is raised by 1.7 cm (BME). Breast area remains unchanged. The postoperative breast parenchymal ratio is 1.84 compared with 1.39 preoperatively. Images are matched for size and orientation. *MPre*, plane of maximum preoperative breast projection. *MPost*, plane of maximum postoperative breast projection. Adapted with permission from *Plast Reconstr Surg*. 2014;133:284e–292e.[35]

improvement in the breast parenchymal ratio (+0.26) despite the presence of implants. The geometry simply does not permit much lower pole elevation because there is no lower pole reduction, permitting a "mastopexy-wrecking bulge,"[116] caused by inadequate resection of lower pole parenchyma, leading to persistent glandular ptosis.[40,106] Central mound techniques require skin undermining, increasing the risk of delayed wound healing.[9] Measurement changes are similar to those produced by implants alone[14,107–109] (Fig. 3). Breast implants push the lower pole level and inframammary fold down.[14,107–109]

Inverted-T, Superior Pedicle Augmentation/Mastopexy

An inverted-T, superior pedicle augmentation/mastopexy incorporates a lower pole tissue resection, allowing effective lower pole elevation (Figs. 4, 9). As in any inverted-T technique, there is a risk of nipple overelevation because transposition of the nipple/areola on the breast mound is needed to offset the paradoxical glandular descent.[19] An under-recognized disadvantage of a superior pedicle dissection is the loss of deep nipple innervation provided by the lateral cutaneous branch of the fourth intercostal nerve, causing more nipple numbness than other mammaplasty dissections.[117]

Inverted-T, Inferior Pedicle Augmentation/Mastopexy

The inverted-T, inferior pedicle mammaplasty is well-known to North American surgeons,[19] who frequently learned to perform breast reduction using this method and then adapted it to augmentation/mastopexy. The blood supply to the nipple/areola is jeopardized because there is no superficial axial blood supply provided by an inferiorly-based pedicle, which may be lengthy in women with major ptosis. Simultaneous implant placement may further jeopardize nipple/areola viability.[106] The base of the pedicle remains attached, so that there is no upward mobility of the inframammary fold. This method provided the least amount of lower pole elevation among the 5 procedures (0.3 cm, not significant). Tissue resection is performed superiorly, medially, and laterally, preserving glandular tissue in the lower pole. Upper pole tissue resection may compromise upper pole projection; none of the inverted-T methods achieved significant increases in upper pole projection despite the presence of breast implants (Fig. 10). Some of the limitations of the inverted-T, inferior pedicle method are apparent in Figure 5. The inframammary fold level is unchanged. The horizontal scar extends to the anterior axillary line.

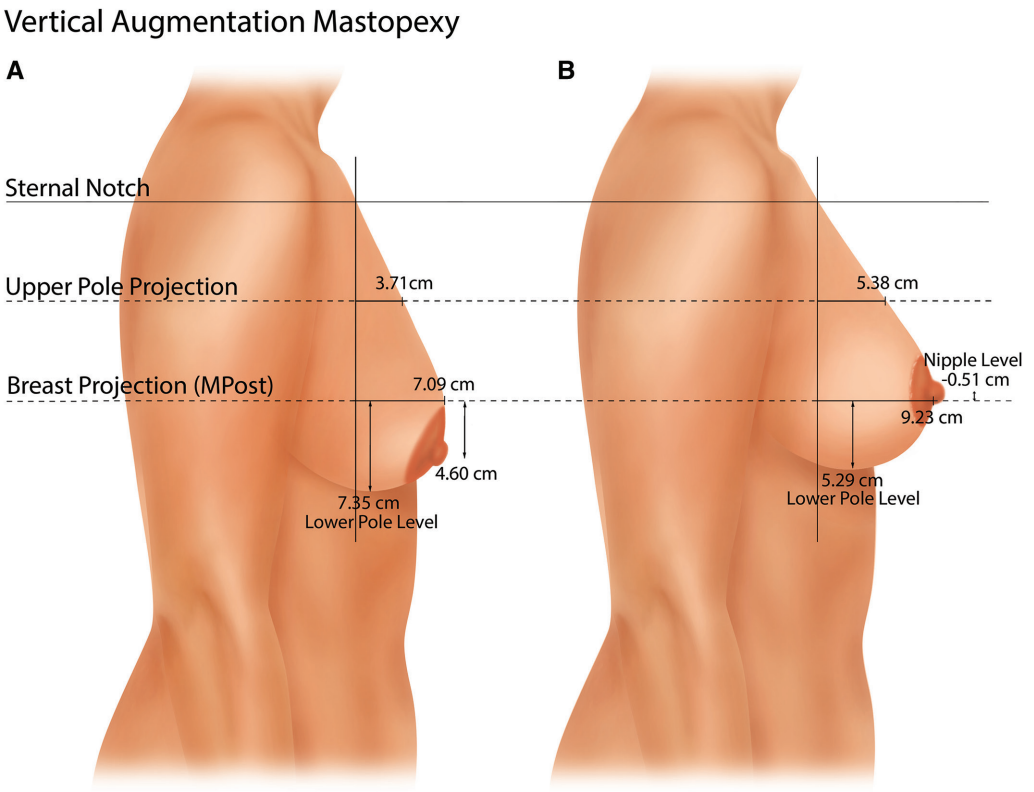

Fig. 6. This mammographic illustration depicts the mean measurements before (A) and after (B) vertical augmentation/mastopexy. The lower pole level is elevated by 2.1 cm.

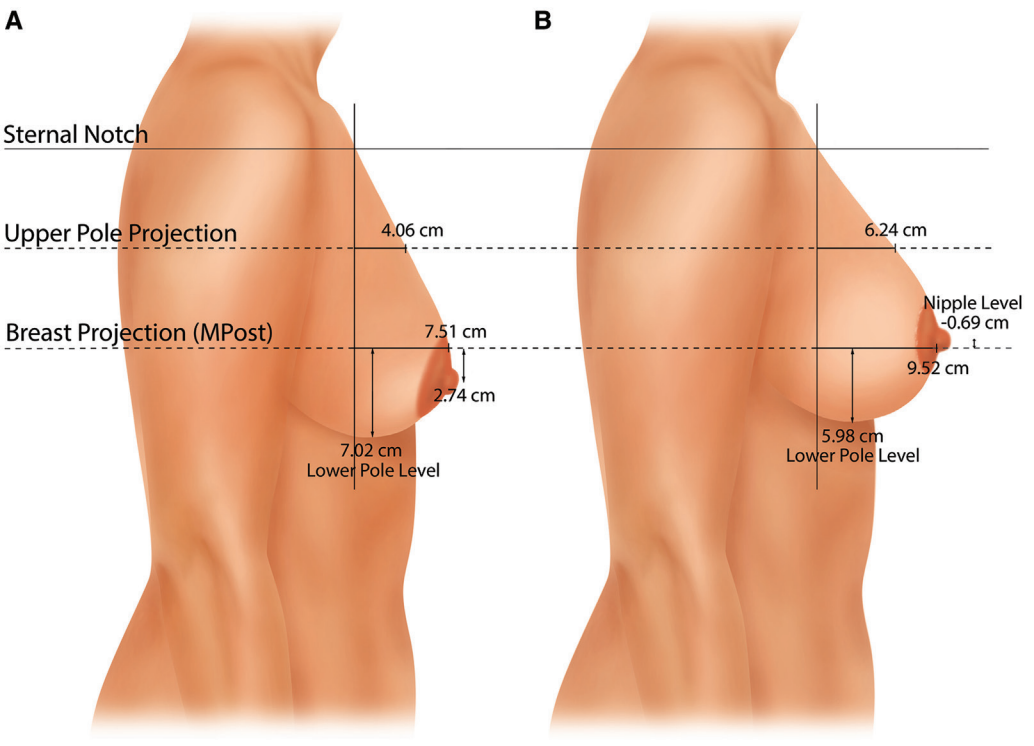

Fig. 7. This mammographic illustration depicts the mean measurements before (A) and after (B) periareolar augmentation/mastopexy. The lower pole level is elevated by 1.0 cm.

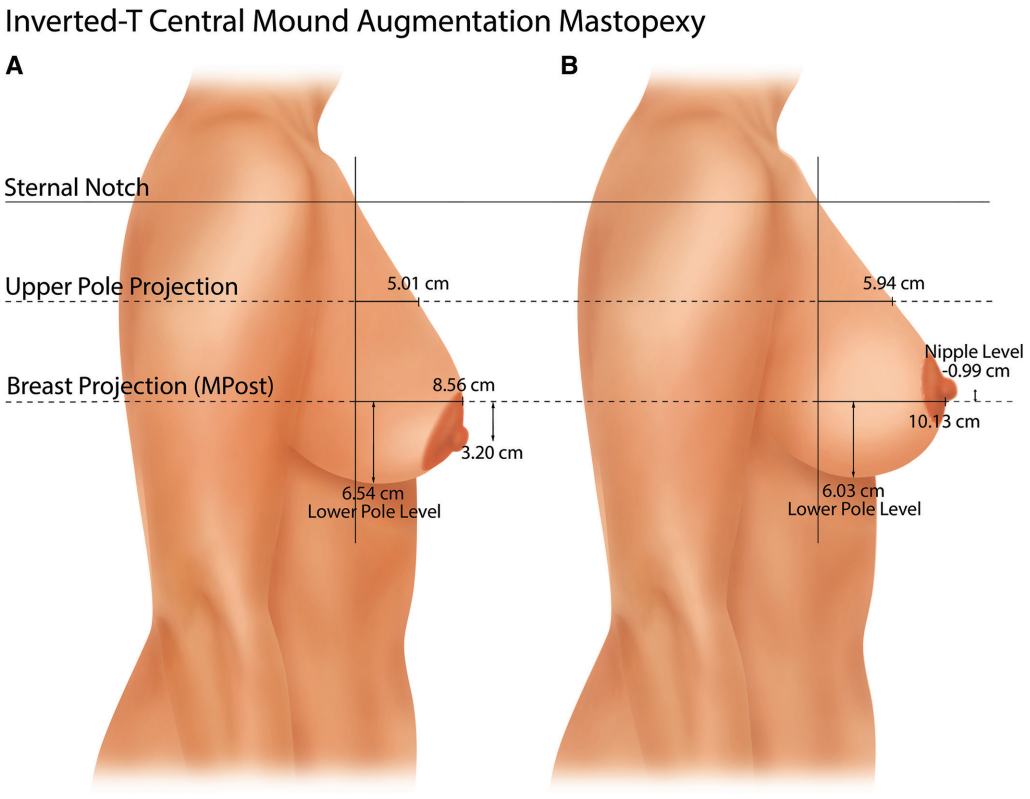

Fig. 8. This mammograph depicts the mean measurements before (A) and after (B) inverted-T, central mound augmentation/mastopexy. The lower pole level is elevated by 0.5 cm. The nipple is overelevated by 1.0 cm.

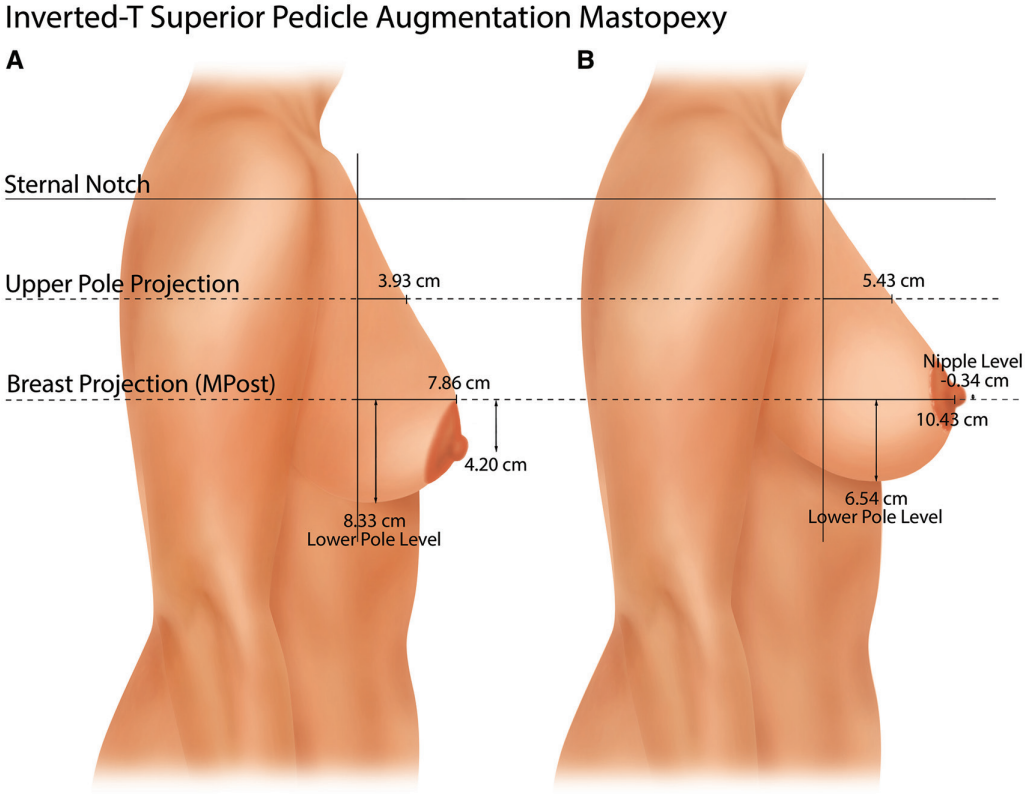

Fig. 9. This mammograph depicts the mean measurements before (A) and after (B) inverted-T, superior pedicle augmentation/mastopexy. The lower pole level is elevated by 1.8 cm.

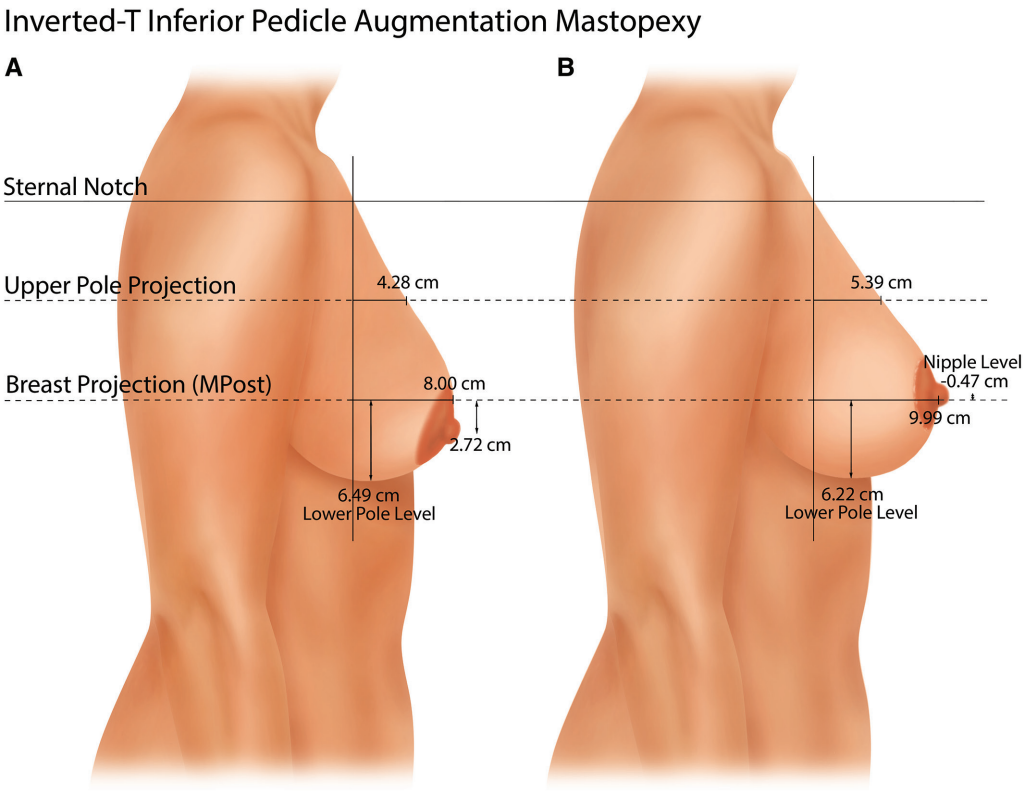

Fig. 10. This mammograph depicts the mean measurements before (A) and after (B) inverted-T, inferior pedicle augmentation/mastopexy. The lower pole level is minimally elevated (0.3 cm). Upper pole projection is increased by 1.1 cm.

Although many investigators have attempted to manipulate inferiorly-based parenchymal tissue to simulate an implant in the manner of Ribeiro[118] and Graf et al,[119] measurements fail to support the efficacy of these auto-augmentation methods.[19,120]

Other Methods

Augmentation/mastopexy methods that were evaluated but did not fit into 1 of the 5 groups merit discussion. In 2019, Munhoz et al[16] published their composite reverse inferior muscle sling (CRIMS) mastopexy. Munhoz et al[16] essentially described a "reverse" dual plane approach, providing redirected muscle cover for the implant inferiorly, and positioning the implant superficial to the pectoralis muscle superiorly. The authors' breast volume measurements, which reportedly showed a 31% decrease 1 year after surgery,[16] are a cause for concern. The median resection weight was 155 g and the median implant volume was 255 mL. One would expect a net increase in volume, not a decrease. A net increase in breast volume is the goal in women treated with augmentation/mastopexy,[40,107] and this objective was achieved by all 5 traditional methods evaluated in this study. Moreover, measurements on before-and-after images were complicated by the authors' use of digital editing to change the background, encroaching on the breast border. Nevertheless, measurements were possible, revealing a surprising reduction of breast projection, upper pole projection, and area, despite the inclusion of a breast implant.

Pacifico[45] recently described a superiorly-based deepithelialized skin flap anchored to the chest wall at the inframammary crease to support the breast implant. Measurements failed to support its efficacy. The lower pole level descended 1.0 cm after surgery, with no breast mound elevation, similar to the effect of a breast implant alone.[107] The breast parenchymal ratio decreased (–0.44) after surgery.

The crescent mastopexy technique[26] provided minimal change in the lower pole level, and no breast mound elevation or change in the breast parenchymal ratio, as expected for a minimalist operation that does not include a lower pole reduction. The minus-plus method effectively elevated the lower pole level and raised the breast mound. However, the authors' B-mastopexy[22] has not been widely adopted by plastic surgeons.

Limitations of the Study

Many published studies could not be evaluated because lateral photographs were not provided, underscoring the importance of these images, which are part of the standard views for breast surgery.[121] Of the 7 measurement parameters, 6 require lateral views for evaluation (all except the lower pole level). Few studies reported tissue resection weights, which might affect the comparisons. Similarly, few studies reported the specific type of breast implant and profile. The effect of follow-up time on breast shape was not evaluated. Upper pole volume is gradually lost and the lower pole settles after surgery,[122] affecting measurements in patients with longer follow-up times.

Strengths of the Study

Photographic matching and measurements provide an objective means to compare results. Quantitative data are reported. This information may be used by surgeons and patients when selecting an augmentation/mastopexy method.

CONCLUSIONS

Comparison of matched photographs and measurements are essential when comparing published augmentation/mastopexy methods. Breast implants reliably increase breast projection and upper pole projection. Vertical augmentation/mastopexy significantly elevates the lower pole and increases the breast parenchymal ratio, meeting the surgical objectives. Nonvertical methods are limited by less favorable geometric and anatomic considerations. Periareolar and central mound methods do not include a lower pole resection, compromising the lift effect.

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ACKNOWLEDGMENTS

The author thanks Jane Zagorski, Ph.D., for statistical analyses and Gwendolyn Godfrey for illustrations.

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