

ORIGINAL RESEARCH ARTICLE

Preservation of breast ligamentous structures in mastopexy: achieving aesthetic excellence with minimal complications

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Background: Breast ptosis has traditionally been addressed through mastopexy techniques, but there is an increasing focus on preserving breast anatomy to minimize complications. This includes conserving critical ligamentous and fascial structures, considering that traditional techniques may lead to loss of support and adverse outcomes.

Objective: The study aims to introduce a novel mastopexy technique that prioritizes ligament preservation, with the option to include breast implants, emphasizing patient safety and exceptional aesthetic outcomes.

Design: The study design included a descriptive statistical analysis of a novel mastopexy technique applied to 138 patients with a minimum 1-year follow up, performed by a single surgeon in San José, Costa Rica, from August 2020 to September 2022. Preoperative measurements, breast implant data, and postoperative outcomes were described.

Results: A total of 138 patients who underwent preservation mastopexy were analyzed. The median age was 39 years (interquartile range [IQR] 33 – 45) with a 28-month median follow-up. Preoperative measurements included a median nipple-to-inframammary fold distance of 9.5 cm (IQR 8 – 11) and a base diameter of 10.5 cm (IQR 10 – 11). Major complications included one readmission for hematoma drainage (0.7%), no major flap or nipple loss, and minor issues involving dog ears (1.4%) and hypertrophic scars (1.4%) requiring revisions. No seroma or implant-related complications were reported.

Discussion: This study's innovative mastopexy technique prioritizing breast ligament preservation, with or without adjunctive implants, achieved excellent aesthetics and low complications. This approach, aligned with personalized breast surgery principles, demonstrates the significance of preserving ligamentous support and natural breast architecture. Safety concerns were effectively addressed, emphasizing the technique's ability to reduce adverse events, substantiated by statistical evidence and earlier studies.

Conclusions: This study demonstrates a low complication rate and favorable aesthetic outcomes with a novel mastopexy technique that prioritizes breast ligament preservation. It utilizes breast implants when needed as an addendum to preexisting breast tissue, basing its selection on objective measurements and overall body proportions.

Keywords: mastopexy techniques; Cooper ligaments; inframammary fold; breast implants; preservation of breast anatomy; surgical safety; aesthetic outcomes; personalized breast surgery

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Breast ptosis, characterized by the descent of breast tissue and the nipple–areola complex (NAC) has been addressed through several mastopexy techniques. However, increasing emphasis should be placed on preserving the natural anatomy of the breast to address instability and minimize complications. This includes the conservation of ligamentous structures, such as Cooper's ligaments and the superficial fascia system of the breast, which are crucial for the breast's natural shape and support (1–3). Traditional

mastopexy techniques often involve ligament manipulation or release, potentially leading to loss of support and complications. This article introduces a novel mastopexy technique that prioritizes the preservation of these vital structures, ensuring long-term stability while enhancing aesthetic results.

The proposed technique allows the inclusion of adjunctive breast implants in two simple steps when necessary. However, these implants are used exclusively as an addendum to the preexisting breast tissue, rather than as the

primary means of augmentation. The decision whether or not to include breast implants should be made preoperatively on an individualized basis and will be described in more detail in the article.

Additionally, our technique places emphasis on safety, aiming to minimize complications. Initial results have indicated a notably low occurrence of postoperative issues. These findings underscore the importance of complication reduction in mastopexy procedures to optimize patient outcomes and satisfaction (4, 5). Furthermore, our preservation approach consistently achieves outstanding aesthetic results and long-lasting breast stability, aligning with prior studies that emphasize the importance of preserving breast anatomy for natural-looking outcomes (6–9).

In conclusion, our innovative mastopexy technique prioritizes breast ligament preservation and enhances preexisting breast tissue, offering a balanced, safe solution to minimize complications and achieve exceptional, enduring aesthetic results. Future research will expand our understanding of this technique, contributing to the field of aesthetic breast surgery through larger-scale studies and long-term follow-up.

Materials and methods

Study design

The study design comprised a descriptive statistical analysis of a novel mastopexy technique applied to 138 consecutive patients by a single surgeon in a surgical center in San José, Costa Rica. The inclusion criteria encompassed patients who underwent augmentation mastopexy from August 2020 to September 2022 and had a minimum of 1 year of follow-up. Exclusion criteria involved the absence of complete data. Preoperative measurements, breast implant information and postoperative outcomes were described. Data analysis involved using the median and corresponding percentiles. This decision was based on an evaluation of variable distributions through the Kolmogorov test, which demonstrated non-normal distributions for all variables. In addition, for categorical variables, both relative and absolute frequencies were determined.

Implant selection

Preoperatively, it is determined whether or not an implant will be used as an addendum to breast tissue during a mastopexy. The decision depends on the density and volume of preexisting breast tissue, and the patient's age, expectations, physical demands, and acceptance of including a device that will likely need to be replaced after a number of years. At this time, the implant is selected according to the pre-existing volume and projection of the breast (measured by a 3D

scanner), the base of the breast within the limits of the circummamillary ligaments, and the distance between the lower edge of the NAC and the IMF. Knowing this data, the use of the implant manufacturer's matrix is quite simple.

Preoperative marking

Patients were marked in an upright position. A midline was drawn from the SupraSternal Notch (SSN) to the pubis, and then the Inframammary fold (IMF) and the mammary axis were delineated. The M line[®] was determined as a horizontal line above which the swell of the breast diminishes, and the patient believes she has little to no breast volume. The new nipple position was defined by projecting the apparent midpoint of the IMF onto the upper pole of the breast, placing the thumb in opposition, trying to visualize the resulting breast once it has been repositioned. The position must be close to the mid-humerus level and 19–22 cm from the SSN. Finally, an oval shape is drawn from the new position of the nipple to the lowest part of the NAC; this area around the new NAC will subsequently be de-epithelialized (Fig. 1).

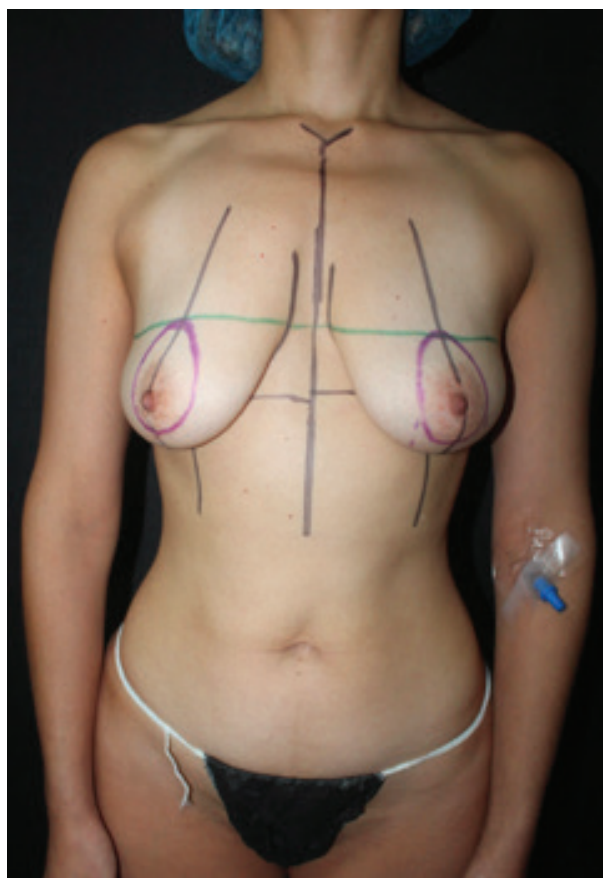


Fig. 1. Preoperative Markings. Green line: M line.

Operative technique

Under general anesthesia, with the patient in the supine position, the areola was slightly stretched and marked with a 4-cm areolotome. The central part of the breast was infiltrated from the new position of the nipple to 2 cm below the IMF in a subdermal plane with a Klein kind solution. The previously marked periareolar area till the new nipple position was deepithelialized. An inferior hemi-periareolar incision is made through the dermis and then extended downward vertically to 2 cm above the IMF. The skin of the central aspect of the lower pole of the breast is undermined in a subdermal plane using dissecting scissors. The area to be undermined extends inferiorly 2 cm below the IMF and laterally according to the estimate of the excess skin that will need to be removed (Fig. 2).

Accessing through the vertical incision made previously, a 3-cm horizontal cut is made in the middle of the IMF up to above the fascia of the pectoralis major. From there, the dissection of the pocket is carried out superiorly, laterally, and medially in a subglandular plane within the limits of the circummamillary ligaments, preserving them. Then, by palpating the superficial wall of the pocket, the real lower limit of the IMF is identified and the abdominal subcutaneous tissue that has been invading the breast area throughout the entire IMF is removed (Fig. 3).

After performing hemostasis and washing the pocket with saline, the same technique is performed on the contralateral breast. Once both breasts have been dissected,

the patient is placed in a semi-sitting position to begin closure. At this point, depending on the density and volume of the breast tissue and the objectives of the procedure, it is decided whether or not to use a breast implant as an addendum. If the implant is used, it is placed inside the pocket and the horizontal cut in the IMF is closed with Maxon® 3-0 deep interrupted sutures. The upper point of the NAC is fixed in position with 3-0 Monocryl®. The mammary gland under the undermined skin is plicated from the most lateral and medial ends to the middle of the breast using interrupted 3-0 Monocryl® sutures (Fig. 4).

The dermo-epidermal flaps are stretched forward using mosquitoes at the free upper ends and a single hook below the lower end of the vertical incision. An intestinal clamp is then used to pinch the base of the flaps. The curvature of the intestinal clamp simulates the natural curve of the lower pole of the breast. A line is drawn on the skin outside the clamp bite, the clamp is removed, and the flaps are cut 5 mm medial to the lines. The lower edge of the flaps is left intact. The skin of the vertical incision is closed using interrupted 3-0 Monocryl® sutures for the dermis followed by a subcuticular suture with 4-0 Monocryl®. A curved horizontal incision is made 5.5 cm below the inferior border of the NAC, following the shape of the IMF. Subdermal dissection is performed downward to the base of the still attached flap (Fig. 5).

Once freed from the sides, the entire dermo-epidermal flap is stretched upward, covering the breast. This

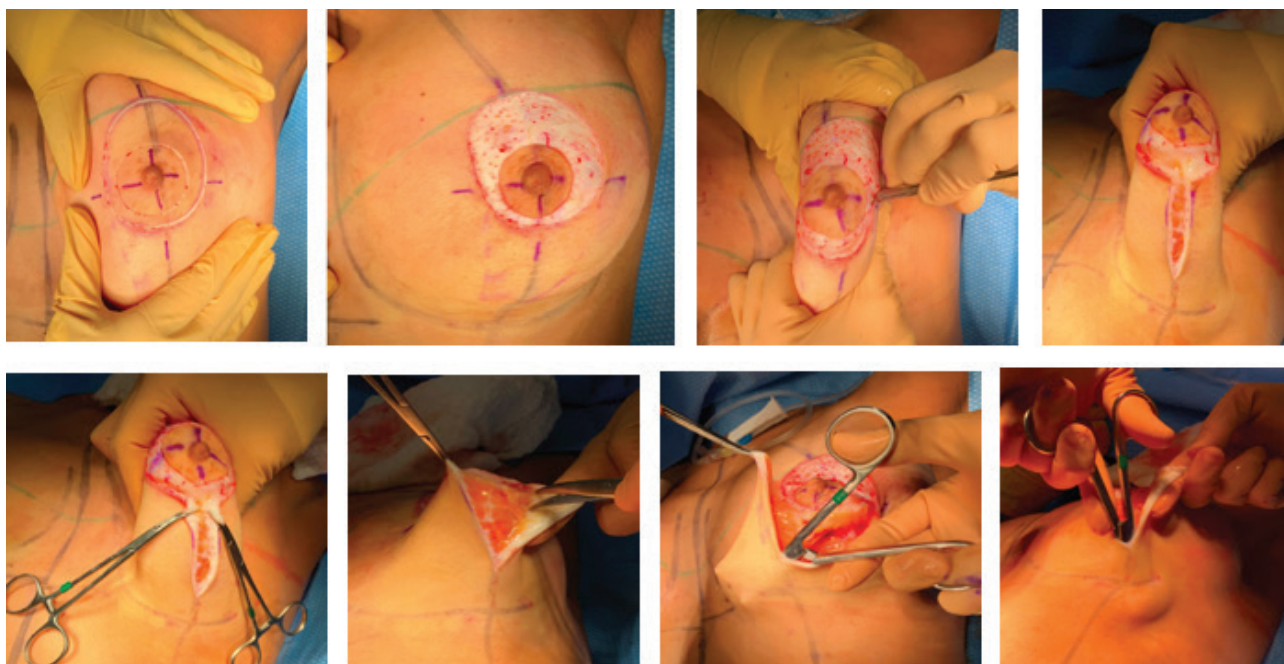


Fig. 2. Areolar marking and subdermal undermining.

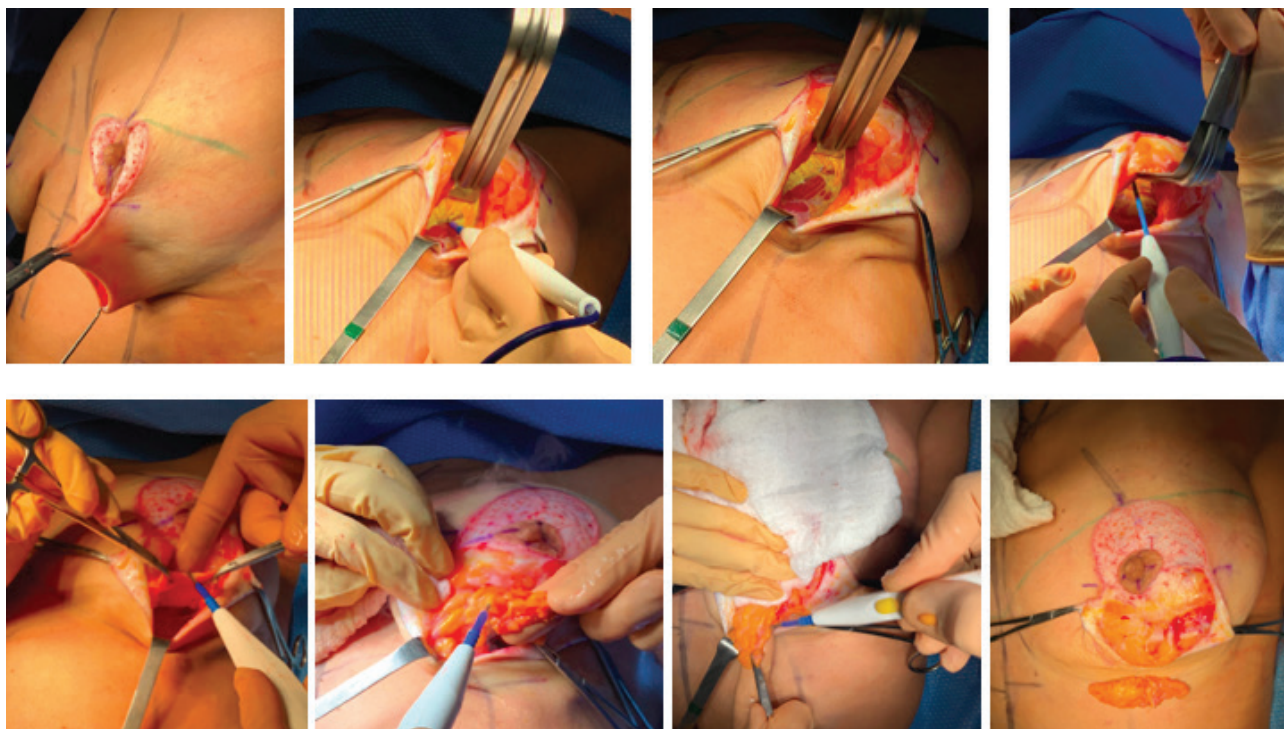


Fig. 3. Subglandular dissection and IMF restoration.

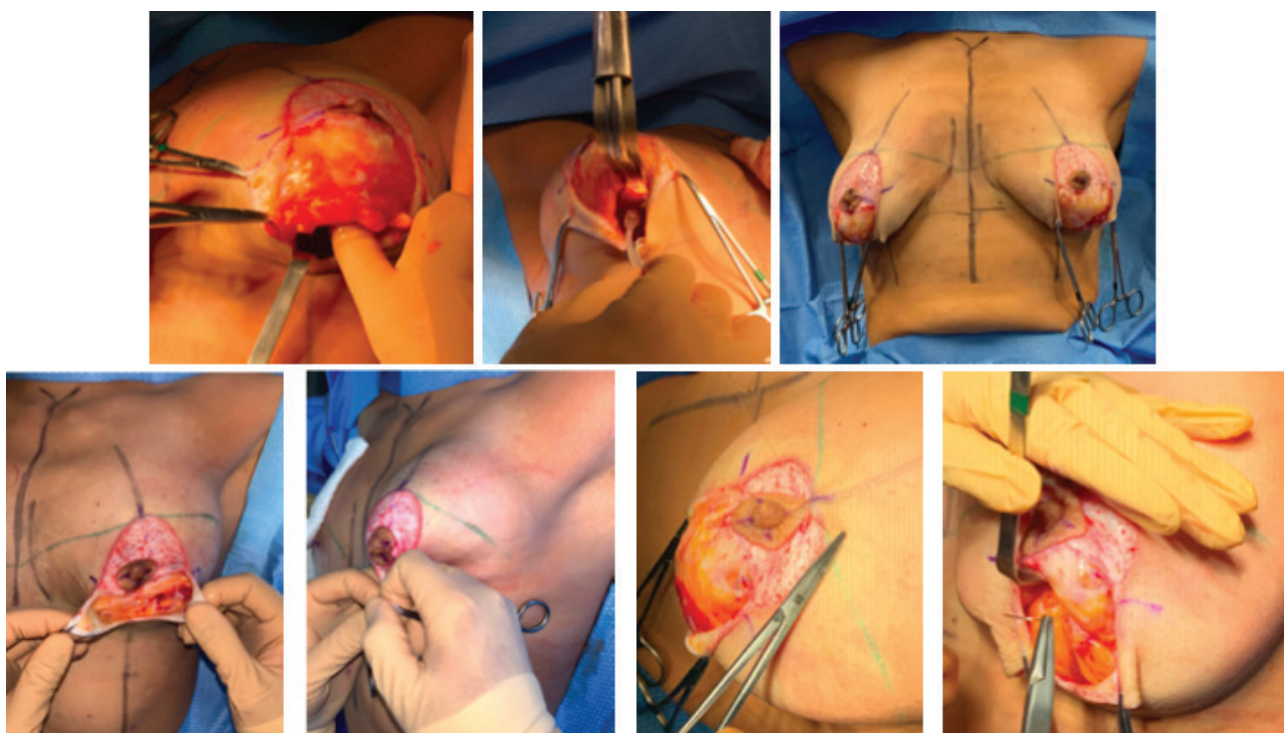


Fig. 4. Initial closure and implant decision.

maneuver allows the overlap of the flap with the IMF to be seen and the excess skin above it to be removed. The base of the mammary gland is then secured to the IMF

insertions on the chest wall with a 3-0 Maxon® central suture. At this time, to avoid dog ears, a portion of subcutaneous tissue and fat is removed from the corners of

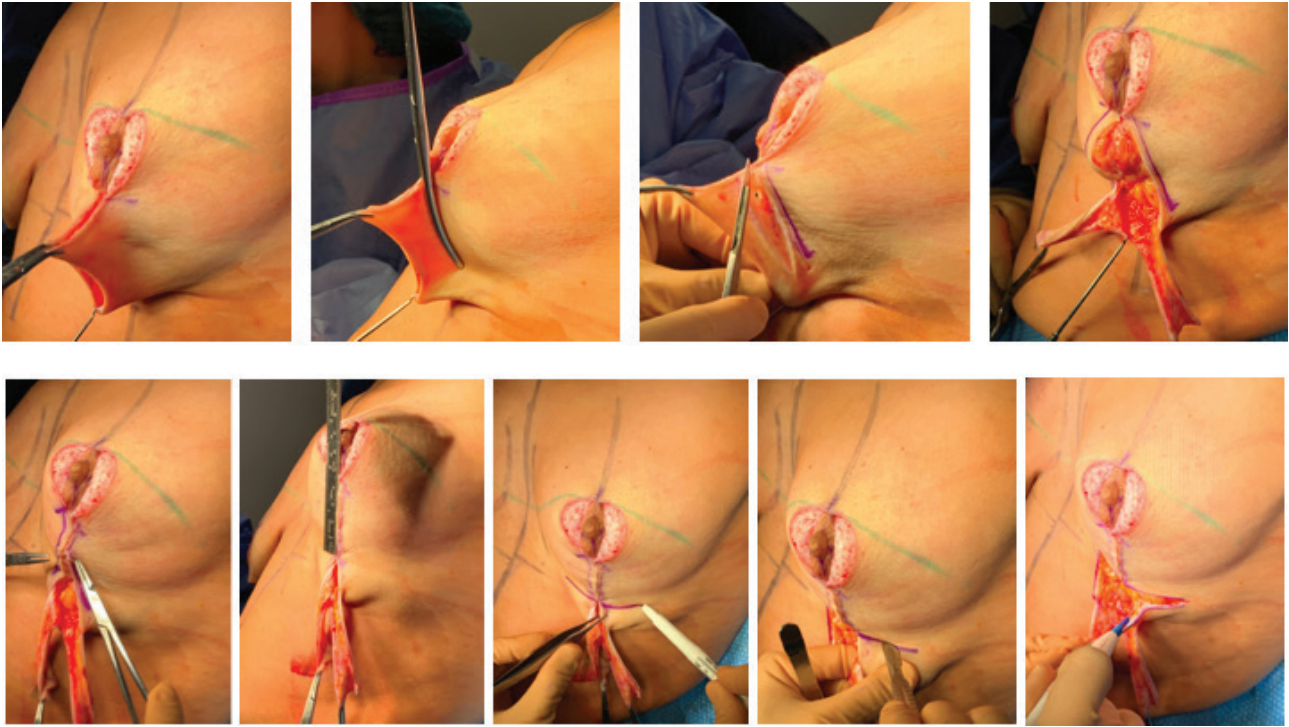


Fig. 5. Flap adjustment and vertical skin redraping.

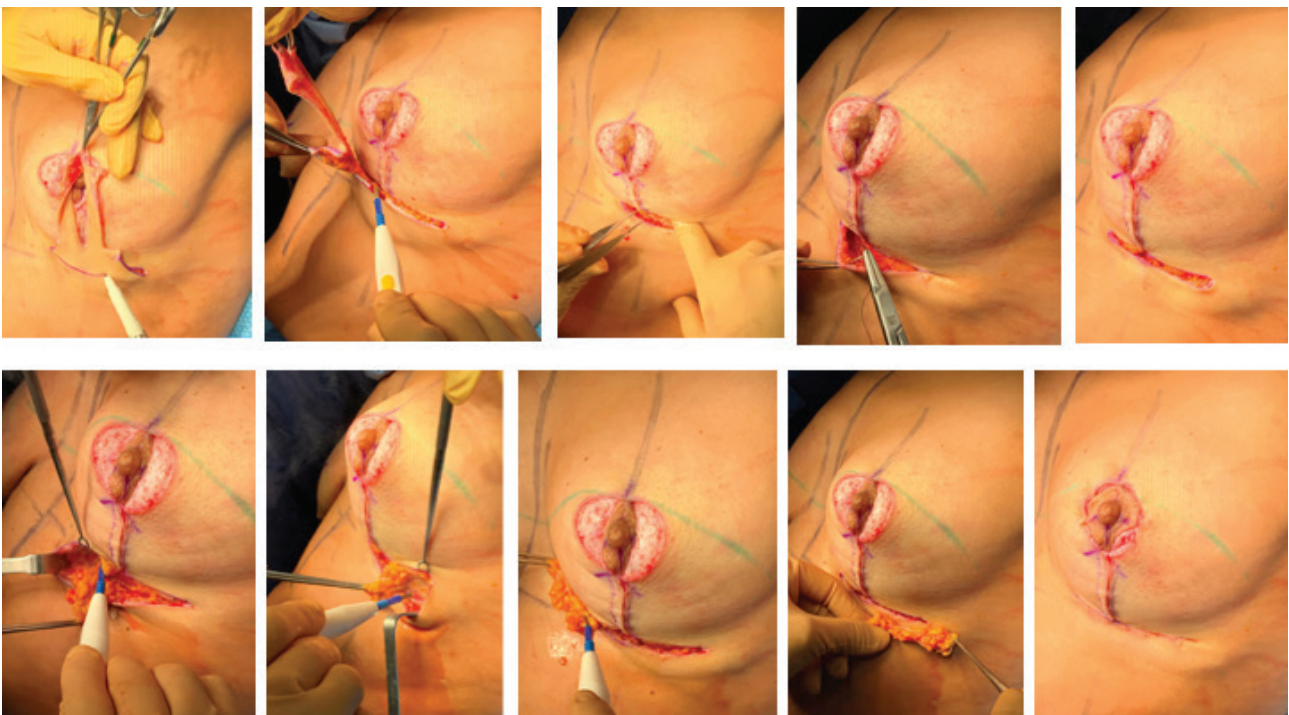


Fig. 6. Horizontal skin redraping, gland fixation, and closure.

the horizontal incision. Finally, the horizontal incision is closed using 3-0 Monocryl® interrupted sutures for subcutaneous tissue and dermis, followed by a subcuticular suture with 4-0 Monocryl®. The areola is closed

with 3-0 Monocryl® cardinal discontinuous sutures followed by a subcuticular suture with 4-0 Monocryl® (Fig. 6). Figure 7 shows the immediate postoperative results of a primary mastopexy without implants (Fig. 7).



Fig. 7. Immediate postoperative results of a primary mastopexy without implants.

No drains were placed in any of the patients. The wounds were covered with absorbent dressings followed by micropore. Soft elastic bras were placed immediately after the procedure and worn for an average of 1 month. Patients were generally discharged on the same day of the procedure.

Postoperative care

After 3 days, a first postoperative control and dressing change was performed. All skin stitches used were absorbable. A follow-up protocol was scheduled at 1, 3, 6, and 12 months after surgery, and then every 2 years with ultrasound control. Patients were instructed to refrain from physical exercise and sexual activity for 1 month. Weight lifting and intense physical activity could be resumed after the third postoperative month. Breast measurements were taken and analyzed during each follow-up visit.

Results

This study enrolled 138 patients who underwent preservation mastopexy between June 2020 and September 2022. The median age was 39 years (interquartile range [IQR] 33 – 45), and the median follow-up period was 28 months (IQR 20 – 35). Preoperatively, the median nipple-to-IMF distance was 9.5 cm (IQR 8 – 11), the base diameter was 10.5 cm (IQR 10 – 11), and the average pre-existing breast volume for both breasts was 478.5 cm³ (IQR 360 – 637.5). All patients were attended by the same surgeon using the preservation mastopexy technique outlined in this article (Table 1).

This study presents the outcomes of patients who underwent augmentation mastopexy, using silicone, smooth nanotextured Motiva® implants in all cases. Primary

Table 1. Patients demographics, operative, and postoperative data

	Median (IQR)
Age (years)	39 (33 – 45)
Follow-up (months)	28 (35 – 20)
Preoperative breast measurements	
Nipple-to-inframammary fold distance (cm)	9.5 (8 – 11)
Base diameter (cm)	10.5 (10 – 11)
Pre-existing breast volume right breast (cm ³)	479 (362 – 646)
Pre-existing breast volume left breast (cm ³)	480 (370 – 655)
Mean pre-existing breast volume (both breasts) (cm ³)	478.5 (360 – 637.5)
Operative data	
Base of implant implanted (cm)	10.5 (10 – 11)
Volume of implant implanted (mL)	205 (160 – 220)
	n (%)
Type of augmentation mastopexy	
Primary	86 (62.3)
Breast implant replacement	38 (27.54)
Primary hybrid	6 (4.35)
Breast implant replacement hybrid	8 (5.8)
Complications	
Reintervention and revision	
Readmission for hematoma drainage	1 (0.7)
Scar revision	2 (1.4)
Minor	
Seroma	0
Dog ears	2 (1.4)
Hypertrophic scar	2 (1.4)
Major flap or nipple loss	0

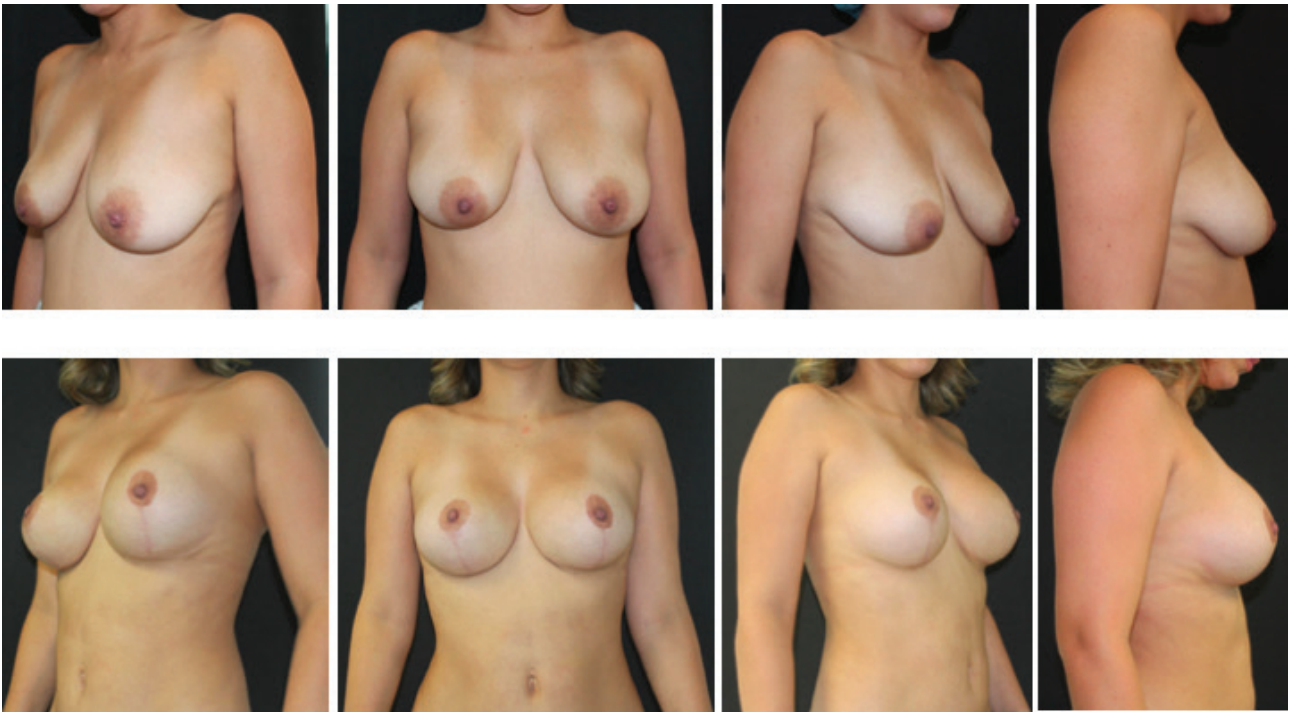


Fig. 8. Preoperative and one-year postoperative views of a 35-year-old woman, with a history of two previous pregnancies and breastfeeding, who underwent a primary mastopexy using 220 cc mini plus Motiva® implants.

mastopexy was the main procedure in the majority of cases (62.3%), followed by breast implant replacement mastopexy (27.54%). A hybrid approach, including additional lipofilling, was used in the remaining 10.15% of cases. The median implant base used was 10.5 cm (IQR 10 – 11), and the median implant volume was 205 cc (IQR 160 – 220) (Table 1).

Major complications included one readmission for hematoma drainage (0.7%), which was successfully resolved during reintervention, while no major flap or nipple loss was observed. Minor complications comprised two cases of dog ears (1.4%) and two cases of hypertrophic scars (1.4%), which required revisions. No cases of seroma or implant-related issues were reported (Table 1). Figures 8 and 9 show the results of two cases in which this mastopexy technique was performed with excellent aesthetic results.

Discussion

Our study presents a comprehensive evaluation of a mastopexy technique that prioritizes the preservation of breast ligamentous structures, with or without the adjunctive use of breast implants, and its significant clinical implications. The analysis of our findings, coupled with a review of the current literature, underscores the importance of this innovative approach in achieving outstanding aesthetic outcomes with a notably low complication rate.

The preservation of ligamentous structures, and breast fascial system, such as Cooper ligaments, the superficial

and deep layers of the superficial fascia, the IMF, and the vertical and horizontal septa, among others, represents a fundamental shift in the paradigm of mastopexy surgery. These structures serve as crucial anatomical elements that contribute to breast shape, projection, and long-term support (1–3, 10–12). Traditional mastopexy techniques often involve ligament manipulation or release, which may compromise the breast's structural integrity and lead to a higher incidence of complications (4, 5, 13, 14). Our technique, which emphasizes the preservation of these essential ligaments, aims to maintain the natural architecture of the breast and, as evidenced by our results, can achieve aesthetically pleasing outcomes with a low complication rate.

Our study also introduces the concept of breast implants as an addendum to preexisting breast volume, rather than as the primary means of augmentation, demonstrating its applicability in both primary mastopexies and implant replacement cases. The inclusion of implants in this technique can be done in two simple additional steps and should be planned preoperatively. Whether or not to use breast implants is decided on an individual basis, depending on the volume and density of the breast and the age, physical demands, and expectations of the patient. This technique aligns with the principles of personalized breast surgery, achieving the desired volume while preserving ligamentous support integrity (6–9).



Fig. 9. Preoperative and one-year postoperative views of a 25-year-old woman, with no history of pregnancy, who underwent a primary mastopexy using 150 cc mini plus Motiva® implants.

As evidenced by the statistics, our study relies on objective measurements of breast base, IMF-to-nipple distance and pre-existing breast volume, and projection to guide implant selection in mastopexy. This prioritizes preexisting mammary tissue and overall body proportions over arbitrary preferences for specific volumes. The approach leads to aesthetically balanced results, aligning with the patient's unique anatomy, in line with previous studies emphasizing the importance of preserving breast anatomy for improved overall appearance of the breasts (15–18).

Safety remains of utmost concern in mastopexy surgery. Our study showcases a remarkably low occurrence of postoperative complications, encompassing hematoma

(0.7%), hypertrophic scars (1.4%), and dog ears (1.4%), while no instances of seroma or implant-related issues were observed. There were no occurrences of major flap or nipple loss in our cohort, and our rates of reintervention and revision remained under 3%. These findings support the contention that the preservation of breast ligamentous structures, coupled with meticulous surgical technique, can significantly reduce the risk of adverse events (19–24).

Conclusions

In conclusion, this study highlights the clinical importance of a mastopexy technique that prioritizes the preservation

of breast ligamentous structures, with or without the adjunctive use of breast implants as an addendum to preexisting breast tissue. The technique's low complication rate and excellent aesthetic results underscore its potential to redefine the standard of care in mastopexy surgery. As we look ahead, continued research and the accumulation of long-term data are essential to further validate and refine this innovative approach, as well as efforts to objectivize its impact in long-lasting stability, ultimately benefiting patients seeking safe and aesthetically pleasing breast rejuvenation.

Conflict of interest and funding

M.C.Q. is a medical consultant and shareholder in Establishment Labs Holdings Inc (NASDAQ: ESTA). The authors have not received any funding or benefits from the industry or elsewhere to conduct this study.

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