CANADIAN SOCIETY FOR AESTHETIC (COSMETIC) PLASTIC SURGERY
SOCIÉTÉ CANADIENNE DE CHIRURGIE PLASTIQUE ESTHÉTIQUE

Breast Surgery

Featured Operative Technique

Periareolar Augmentation-Mastopexy

Aesthetic Surgery Journal
2019, Vol 39(9) 953–965

DOI: 10.1093/asj/sjz128
www.aestheticsurgeryjournal.com
OXFORD UNIVERSITY PRESS

Ryan E. Austin, MD, FRCS(C); Maryam Saheb-Al-Zamani, MD; Frank Lista, MD, FRCS(C); and Jamil Ahmad, MD, FRCS(C)

Abstract

The authors describe their surgical technique for single-stage periareolar mastopexy with subglandular breast augmentation. They have performed this procedure in 85 patients since 2009 and found that this operative technique has allowed them to achieve reproducible outcomes in a single-stage procedure. Periareolar mastopexy with subglandular breast augmentation is an excellent procedure for patients who desire a larger breast size and who present with mild to moderate nipple ptosis with a paucity of excess skin in the lower pole of the breast. This article will review the perioperative management and detailed steps of the procedure and outline its indications for utilization and some of the common complications the authors have encountered.

Editorial Decision date: February 27, 2019; online publish-ahead-of-print May 6, 2019.

Correction of the ptotic and hypoplastic breast with a single-stage procedure can be a daunting procedure for even experienced plastic surgeons.[1,2] Balancing the opposing forces of an augmentation-mastopexy, namely glandular augmentation and skin reduction, requires a thorough understanding of the procedure to achieve reliable results.[3] Though debate continues regarding the utility of this combined procedure, single-stage augmentation-mastopexy has increasingly gained acceptance within the plastic surgery community in recent years.[4]

Single-stage augmentation-mastopexy can be performed employing any combination of implant insertion and skin reduction techniques. The most appropriate technique, however, varies depending on the degree of breast (ie, glandular and nipple) ptosis and the desired amount of volume enhancement. Periareolar augmentation-mastopexy, also referred to as the "donut," "round-block," or "Benelli" augmentation-mastopexy, is one such technique based on the concept of reducing the breast skin envelope by resecting an annular segment of periareolar skin and gathering the breast skin around the nipple-areola complex (NAC).[5-7] This technique has been demonstrated to effectively correct mild glandular ptosis and mild to moderate nipple ptosis while limiting scarring on the breast to an isolated periareolar incision.[4,8-11] Some commonly cited problems of this mastopexy technique include scar widening, NAC distortion, and flattening of breast projection.[3,5-7,11-15]

However, when periareolar augmentation-mastopexy is performed in the appropriate candidate, we have found that this technique can create a full, attractive breast with minimal visible breast scars (Figure 1). Furthermore, this single-stage approach saves the patient from the additional

Dr Austin is a plastic surgeon in private practice in Mississauga, ON, Canada. Dr Saheb-Al-Zamani is a Resident, and Drs Lista and Ahmad are Assistant Professors, Division of Plastic and Reconstructive Surgery, Department of Surgery, University of Toronto, Toronto, Ontario, Canada. Dr Lista is Breast Surgery Section Co-Editor and Dr Ahmad is My Way Section Editor for *Aesthetic Surgery Journal Open Forum*.

Corresponding Author:
Dr Jamil Ahmad, The Plastic Surgery Clinic, 1421 Hurontario Street, Mississauga, ON, Canada, L5G 3H5.
E-mail: drahmad@theplasticsurgeryclinic.com; Twitter: @DrJAhmad

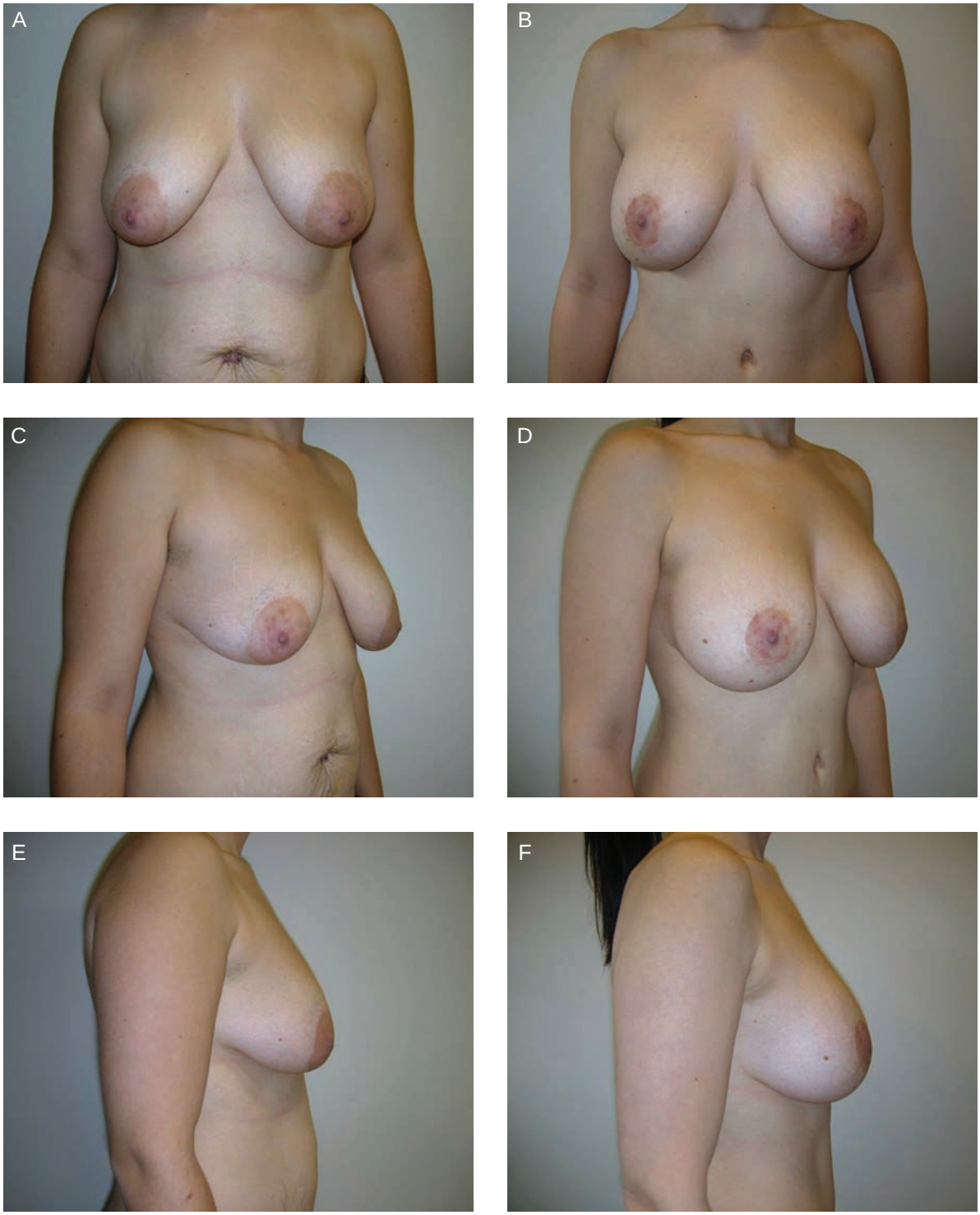


Figure 1. (A, C, E) Preoperative photographs of this 32-year-old postpartum female who presented for periareolar augmentation-mastopexy and concomitant abdominoplasty. (B, D, F) Postoperative result at 17 months following periareolar augmentation-mastopexy with a 330-cc smooth round silicone gel implant.

cost, anesthetic risks, and adverse sequela of the guaranteed second operation in a 2-stage approach.[3,4] In this article, we describe in detail our single-stage approach to periareolar mastopexy with subglandular breast augmentation, and review our experience performing periareolar augmentation-mastopexy in 85 female patients since 2009.

PATIENT SELECTION AND PREOPERATIVE ASSESSMENT

Patient selection is of the utmost importance when selecting appropriate candidates for single-stage periareolar augmentation-mastopexy. In our experience, the ideal candidate for this procedure has mild glandular ptosis and mild to moderate breast ptosis, requiring a correction of no more than 3 to 4 cm of NAC elevation.[3,8,10,14,16] Furthermore, this procedure is particularly beneficial for patients with a tight inferior pole of the breast. In these patients, the lack of excess skin in the lower pole of the breast makes any attempt at vertical or horizontal skin excision difficult, and this is only magnified once the tight lower pole skin envelope has been further expanded by the breast implant.

During the initial consultation, physical examination is focused on assessment of the degree of breast ptosis and the amount of skin excess in the lower pole of the breast. Breast base width is measured to assist with biodimensional planning and implant selection. Implant options within 0.5 cm of the measured breast base width are offered to the patient for sizing. However, we limit implant projection in single-stage procedures to minimize stress on the mastopexy portion of the procedure and therefore avoid full and extra full projection implants in these cases.

Before undergoing this procedure, patients must be nonsmokers or must have quit smoking for 4 weeks prior to surgery. Patients taking oral contraceptive pills are asked to discontinue use for 1 month before and after surgery to minimize the risk of venous thromboembolism (VTE). Prior to surgery, patients should have a stable weight with a body mass index < 35 kg/m^2.

SURGICAL TECHNIQUE

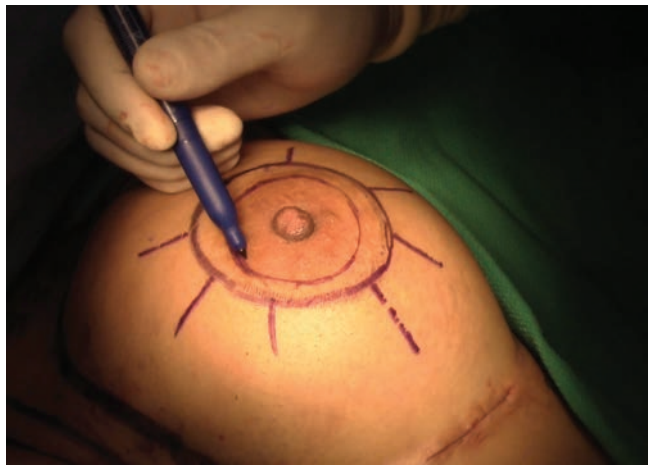
The operative sequence for periareolar augmentation-mastopexy is outlined in Table 1. A detailed video demonstrating the procedure can be accessed in Video 1.

Preoperative Preparation

In the preoperative area, patients are started on our perioperative warming protocol, which is continued both intra- and postoperatively.[17] One hour prior to surgery, patients are premedicated with oral gabapentin 600 mg (Pfizer, Kirkland, Quebec, Canada), celecoxib 200 mg (Pfizer), acetaminophen 1000 mg (Johnson & Johnson, Markham, Ontario, Canada), and ondansetron 8 mg (Novartis Pharmaceuticals Canada Inc., Dorval, Quebec, Canada) to minimize opioid requirements and reduce postoperative nausea and vomiting. Compression stockings and sequential compression devices are placed on the lower extremities prior to the induction of anesthesia to reduce the risk of VTE. Chemoprophylaxis for VTE is utilized in high-risk patients (Caprini/Davison risk assessment model score > 5, or any combined procedure with a total estimated operative duration ≥3 hours). When indicated, chemoprophylaxis with dalteparin sodium 5000 IU (Pfizer) is initiated on the morning of postoperative day 1 and continued for a total duration of 14 days.

Table 1. Operative Sequence for Single-Stage Periareolar Mastopexy With Subglandular Breast Augmentation

Step	Details
1	Markings
2	Infiltration of the inframammary crease incision and borders of the implant pocket
3	Development of subglandular pocket through inframammary crease incision; radial release of breast capsule
4	Irrigation and preparation of subglandular pocket
5	"No-touch" preparation and insertion of breast implant
6	Insertion of angiocatheter into inferolateral subglandular pocket
7	Closure of inframammary crease incision
8	Infiltration of local anesthetic and antiinflammatory mixture into subglandular pocket
9	Adjustment of periareolar markings to ensure symmetry
10	Deepithelialization of periareolar skin
11	Release and undermining of periareolar breast skin
12	Placement of interlocking purse-string suture
13	Subcuticular closure of periareolar incision
14	Application of dressings and surgical brassiere



Video 1. Watch now at https://academic.oup.com/asj/articlelookup/doi/10.1093/asj/sjz128

Markings

Preoperative marking is performed with the patient in the standing position (Figure 2). The midline of the chest is marked as a vertical line between the sternal notch and the xiphoid process. The meridian of the breast is marked as a vertical line down the midline of the breast starting from a point 7 to 8 cm lateral to the sternal notch on the clavicle. Employing bimanual palpation, the level of the inframammary crease is transposed to the central axis of the anterior surface of one of the breasts. This point will serve as the superior border of the new NAC. This marking is then transposed onto the contralateral breast to prevent asymmetry that can be caused by differences in inframammary crease position. The outer marking for the periareolar mastopexy is drawn as an eccentric oval or "egg-shape" to account for the fact that the breast implant imparts greater stretch in the horizontal plane than vertical plane, thereby resulting in a circular shape following implant insertion. This can be simulated by manually placing horizontal stretch on the breast to check the markings, though final markings will be adjusted intraoperatively. Efforts are made to excise all of the pigmented NAC skin; however, if this is not possible it can later be reexcised under local anesthetic.

Markings for the borders of subglandular breast pocket dissection are drawn based on the footprint of the implant centered on the new NAC position. Superomedially, the marking is angled to prevent injury to the second and third intercostal perforators during pocket dissection. Superolaterally, the marking is extended toward the insertion of the pectoralis major muscle to help recruit skin onto the implant and ablate the zone of adherence inferior to the axillary roll. A 4.5- to 5-cm incision is planned in the inframammary crease for subglandular pocket dissection, starting just lateral to the medial border of the new areola.

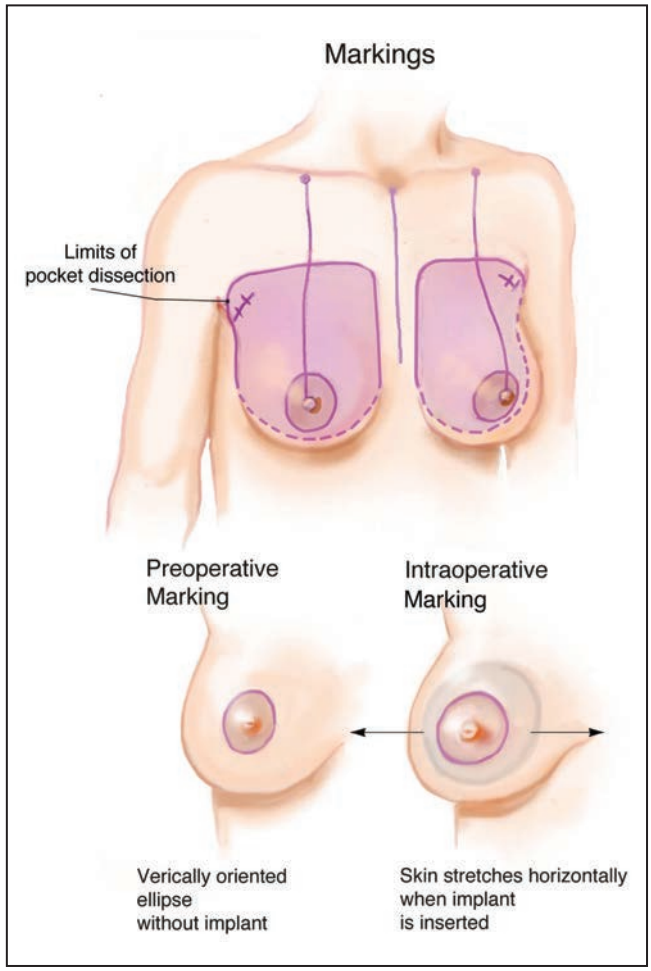


Figure 2. Illustration demonstrating the preoperative markings for periareolar augmentation-mastopexy, which are performed with the patient in the standing position.

Positioning and Preparation

The patient is positioned supine on the operating table with the shoulders abducted 90° and the arms secured to padded arm boards. Prophylactic antibiotics are administered prior to induction of general anesthesia. The chest is prepped and draped in a sterile fashion. Transparent barrier dressings (Tegaderm, 3M, London, Ontario, Canada) are placed over the NAC prior to skin incision to minimize bacterial contamination.[18,19]

Subglandular Pocket Dissection

Subglandular breast augmentation is performed prior to the periareolar mastopexy. The planned incision and the borders of the planned breast pocket dissection are infiltrated utilizing local anesthetic with epinephrine (20 cc per side; 1% lidocaine with 1:100,000 epinephrine [AstraZeneca Canada Inc, Mississauga, ON, CA]). A skin incision in the inframammary crease is made with a no. 15 blade scalpel and is carried down into the breast gland. With retraction on the superior skin edge, the dissection is angled slightly superiorly toward the inferior origin of the pectoralis major muscle. The first fascial layer encountered is the breast capsule (superficial layer of the superficial fascia) and the second is the deep layer of the superficial fascia. Typically, there is fat deep to the deep layer of the superficial fascia in the retromammary space overlying the deep fascia of the pectoralis major muscle. Typically, 2 dense layers of white-colored superficial fascia can be distinctly identified and divided prior to reaching the pectoralis fascia. It is important to be aware of these layers, because they will later be sutured as part of the deep closure when reconstituting the inframammary crease.

Once hemostasis has been achieved, dissection continues with electrocautery to identify the avascular loose NAC

plane between the breast parenchyma and the pectoralis major fascia. A lighted breast retractor is introduced to assist with the remainder of the subglandular pocket dissection. Dissection continues up to the preoperative markings of the breast borders. The superior pocket can be slightly overdissected to allow for soft tissue redraping over the implant. Care must be taken to avoid overdissection laterally, because this can create a lateral malposition. Medial overdissection should be avoided to prevent visibility of the implant edge. During dissection of the pocket, a radial cut of the breast capsule is performed both medial and lateral to the incision employing sharp scissors. Division of these transverse dermal anchoring fibers of the inframammary crease allows for expansion of the tight lower pole of the breast. Performing this radial release early-on during pocket dissection will make it easier to retract and facilitate visualization of the subglandular space.

This sequence is then repeated on the contralateral side, careful to ensure symmetry between the pockets. Significant attention is paid to ensuring meticulous hemostasis on both sides, making certain that the pockets are dry before proceeding with implant insertion.

Pocket Preparation

Once pocket dissection is complete and hemostasis has been achieved, the breast pockets are each irrigated with three 60-cc syringes of quadruple antibiotic solution (Cefazolin 1 g, Clindamycin 150 mg, Gentamycin 40 mg, and Bacitracin 25,000 units in 500 cc of normal saline). The peri-incisional skin is recleansed with chlorhexidine gluconate solution (4%). From this point forward in the procedure, any instrument inserted into the pocket is cleansed with antibiotic solution prior to reinsertion.

Implant Preparation and Insertion

During the process of implant preparation, we adhere to a "no-touch" technique of implant handling. The implant is only handled by the operating surgeon. Prior to accepting the implant onto the sterile field, the surgeon changes into clean sterile gloves. The implant is placed on the sterile back-table and is kept sealed in its inner sterile package. A blunt 18-gauge needle is carefully pierced through the paper packaging and each implant is irrigated with 30 cc of quadruple antibiotic solution.[20] The needle is withdrawn and the package is gently agitated to ensure that the implant is completely coated with the antibiotic solution. This has been demonstrated to reduce electrostatic charge on the implant surface so that debris will not adhere to the implant surface.[20] The implant packaging is kept closed until the implant is ready for insertion to minimize exposure to the ambient environment.

For this procedure, all implants are inserted with the Keller Funnel 2 (Allergan Inc., Dublin, Ireland). The surgeon removes the funnel from its packaging, and the end is cut based on implant size. The internal paper packaging is removed, and the funnel is soaked in quadruple antibiotic solution. The top of the funnel is opened, and the inner lining is irrigated with 60 cc of antibiotic solution. The implant is transferred into the funnel, with care taken to ensure that the implant is not pushed out through the funnel opening prior to insertion to avoid unnecessary trauma to the implant.

For implant insertion, a clean Deaver retractor coated in chlorhexidine gluconate solution is inserted into the subglandular pocket for retraction. The tip of the funnel is completely inserted into the incision prior to expelling the implant to prevent contact with the surrounding skin. Care is taken to insert the device with the tab facing posterior to ensure proper implant orientation. If the implant position or pocket require manual adjustment, the surgeon coats their gloves in quadruple antibiotic solution prior to manipulation.

Pocket Closure

Under direct visualization, an 18-gauge angiocatheter is inserted into the inferolateral aspect of the subglandular pocket, with care taken to protect the implant. The needle is removed, leaving only the blunt-tipped angiocatheter in situ.

The incision is closed in multiple layers to ensure a "water-tight" closure. A 3-point suture with 2-0 Vicryl (Johnson & Johnson) is utilized to repair the superficial layers of the breast capsule to the deep fascia, thus reconstituting the inframammary crease. Three sutures are typically required. The superficial breast capsule closure is reinforced with buried interrupted 2-0 Vicryl sutures, while the skin edges are closely reapproximated with inverted deep-dermal 3-0 Vicryl sutures. This multi-layered closure is important to ensure a "water-tight" seal separating the implant from the skin incision.

Once the skin incision is closed, a 10-cc mixture of local anesthetic (0.25% bupivacaine with 1:100,000 epinephrine) and antiinflammatory (ketorolac 15 mg) is infiltrated into each breast pocket through the angiocatheter. We have found this helps to minimize postoperative discomfort, limits postoperative opioid requirements, and expedites recovery.[21,22] The angiocatheter is then withdrawn and nipple shields are removed.

Mastopexy Markings

Prior to proceeding with the periareolar mastopexy portion of the procedure, it is important to review the mastopexy

markings. The eccentric oval that was marked preoperatively typically becomes more rounded following implant insertion because the implant imparts greater stretch in the horizontal vector than it does in the vertical vector. At this point, the periareolar marking must be adjusted to ensure that it is a symmetric circle. It is important to remember that when adjusting this marking, the only landmark that is never altered is the superior point of the NAC, which was set when the patient was marked in the standing position. A premeasured circular device is employed for the inner marking of the periareolar mastopexy, which defines the boundary for the new NAC. The diameter of the inner circle can be adjusted based on the diameter of the outer circle to minimize tension on the periareolar closure. For small periareolar mastopexies, a 35-mm diameter inner circle is utilized, and for moderate or larger periareolar mastopexies a 44-mm-diameter inner circle is employed.

Periareolar Mastopexy

The inner then outer periareolar incisions are made using a no. 10 blade scalpel, and this annular "donut" of periareolar skin is deepithelialized with a no. 20 blade scalpel. The dermis at the border of the outer circle is released full-thickness with monopolar electrocautery, careful to leave a 5-mm cuff of dermis for later suture repair. The periareolar skin is then circumferentially undermined in the subcutaneous plane for approximately 1 cm to allow for smooth redraping of the breast skin. Undermining is aided by retracting the NAC away from the area of dissection to provide counter-traction. To prevent exposure of the underlying implant, it is important to ensure that undermining stays in the subcutaneous plane and does not angle down into the breast gland itself. Once equal circumferential undermining has been completed, careful hemostasis is obtained.

Interlocking Purse-String Suture and Closure

Closure of the periareolar incision is performed in 2 stages (Figure 3). The first stage involves an interlocking purse-string closure with a permanent suture.[23] This suture functions to gather the periareolar skin and to offload tension from the periareolar scar so as to prevent spreading or hypertrophic scarring of the NAC.[24] A Gore-Tex suture on a CV-2 long straight needle (W.L. Gore & Associates, Flagstaff, AZ) is utilized. Prior to placement of the interlocking purse-string suture, it is important to place orientation markings on both the NAC and the periareolar skin to ensure an equal distribution of tension during closure.

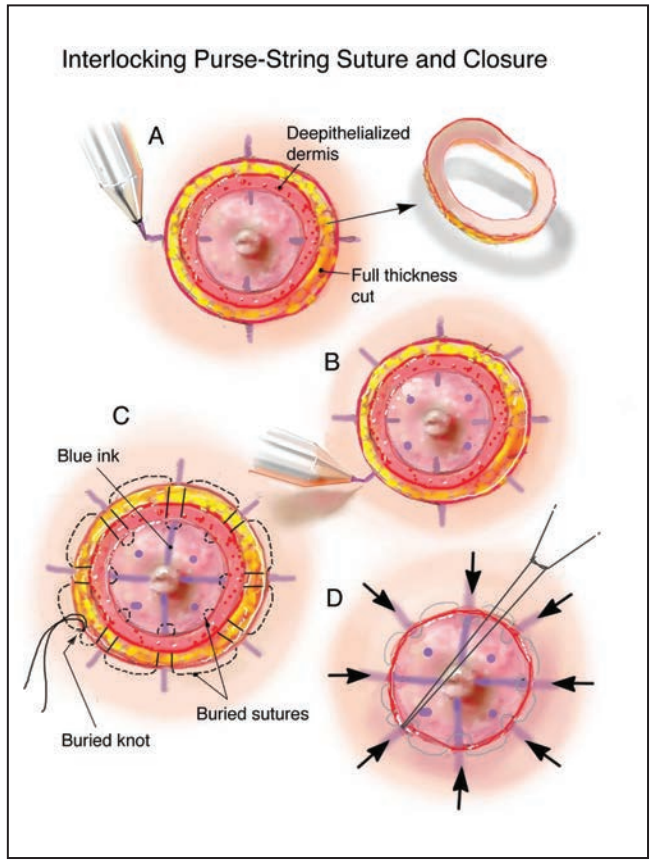


Figure 3. Illustration demonstrating the interlocking purse-string suture and closure.

Markings are made at the 12, 3, 6, and 9 o'clock positions of the NAC and the periareolar skin, with another marking placed halfway between each of the aforementioned landmarks. This provides a total of 8 reference markings for closure. Because the Gore-Tex suture is a permanent monofilament suture, we treat it as other permanent implants. The suture is minimally handled and soaked in a chlorhexidine gluconate solution prior to use. Starting in the inferolateral quadrant of the outer circle, the suture is passed from deep-to-superficial through the dermis approximately 1 cm from the edge of the periareolar skin. A snap is placed at the end of the suture to prevent pull-through during suture placement. The suture is then passed around the circumference of the periareolar incision in an interlocking "wagon-wheel" fashion. When placing this suture, there are a few technical details important to remember. First, the dermal passes on the outer circle should be made approximately 1 cm from the dermal edge. This not only helps to gather the periareolar skin and offload tension from the periareolar scar but also ensures that the permanent Gore-Tex suture does not lie directly under the incision, which can help prevent infections of the Gore-Tex suture in cases of superficial wound breakdown. Secondly,

the starting point for suture passes on the outer circle must be made directly adjacent to the endpoint of the previous suture pass; otherwise, tension will not be evenly distributed, and this may lead to gapping and irregular bunching of the skin edges.

Once the circumference of the areola has been traversed, the suture is passed from superficial-to-deep directly adjacent to the original suture starting point. The ends of the Gore-Tex suture are then evenly pulled to cinch down and gather the periareolar skin. Once the appropriate tension is achieved, the suture is secured with a minimum of 8 to 10 knots. The free end of the Gore-Tex suture is cut with a 3- to 4-mm tail, and the straight needle is passed from deep-to-superficial through the incision line to exit laterally through the breast skin. The suture is then cut at the level of the skin. This maneuver will bury the Gore-Tex suture knot away from the incision. Care must be taken when burying the knot that the needle does not nick or cut the Gore-Tex suture, as this can weaken the permanent stitch and lead to early failure.

Finally, the periareolar incision is closed with a running subcuticular 4-0 Monocryl Plus suture (Johnson & Johnson). The buried knot of the Monocryl Plus suture is placed at the lateral-most point of the periareolar incision to offset it from the buried knot of the Gore-Tex suture. In the event of superficial suture extrusion or a suture abscess, this offset prevents exposure or contamination of the underlying Gore-Tex stitch.

Application of Dressings

At the completion of the procedure, both the inframammary incision and the periareolar incision are sealed with the Dermabond Prineo Skin Closure System (Ethicon Inc, San Lorenzo, PR). This dressing creates a water-resistant barrier, thereby allowing patients to shower starting on the second postoperative day. Nonadherent dressings and an absorbent pad are placed over the Prineo, and patients are placed into an appropriately sized surgical brassiere.

Postoperative Care

Patients continue on a multimodal postoperative oral analgesia protocol consisting of acetaminophen 1000 mg every 8 hours for 5 days, celecoxib 200 mg once daily for 5 days, and hydromorphone 1 to 2 mg 1 to 2 tablets every 6 hours as needed. Patients receive ondansetron 8 mg 3 times daily for 1 day to reduce postoperative nausea and vomiting. Patients also take 5 pellets of Arnica montana 12C (Boirion, Saint-Bruno-de-Montarville, QC, Canada) 3 times daily for 10 days to minimize swelling and bruising.

All patients are seen for routine postoperative follow-up on postoperative day 1, then weekly for 1 month. The Prineo dressing is removed at 2 weeks postoperatively, and scar care with silicone sheeting is initiated once the incision is completely healed. Starting at 2 weeks postoperatively, patients begin daily implant massage exercises. After 1 month, patients return for routine checks at 3, 6, and 12 months postoperatively. Following that time, we encourage patients to return for yearly checks, though visits are scheduled on an as-needed basis.

CLINICAL EXPERIENCE

Patient Demographics and Procedural Characteristics

We performed a retrospective review of all patients who underwent single-stage periareolar augmentation-mastopexy by 1 of the 2 senior surgeons (F.L and J.A.) utilizing the aforementioned technique. We identified 85 consecutive female patients who underwent this procedure between February 2009 and July 2017. Regarding patient demographics, average patient age was 34 years (range, 17-62 years) with a mean body mass index of 24.0 kg/m^2 (range, 16.8-36.9 kg/m^2). Twelve patients (14%) were smokers but quit smoking for 1 month before surgery. In regard to breast implant selection, textured round silicone gel implants were employed in 53 patients (62.3%) and smooth round silicone gel implants in 32 patients (37.6%). Average breast implant volume was 350 cc (range, 200-650 cc). All breast implants were placed into a subglandular pocket. Twenty-three patients (27.1%) underwent periareolar augmentation-mastopexy in combination with an additional procedure. The average length of follow-up for this cohort was 409 days (range, 12-2636 days). The principles outlined in the Declaration of Helsinki were followed throughout the study.

Challenges and Complications

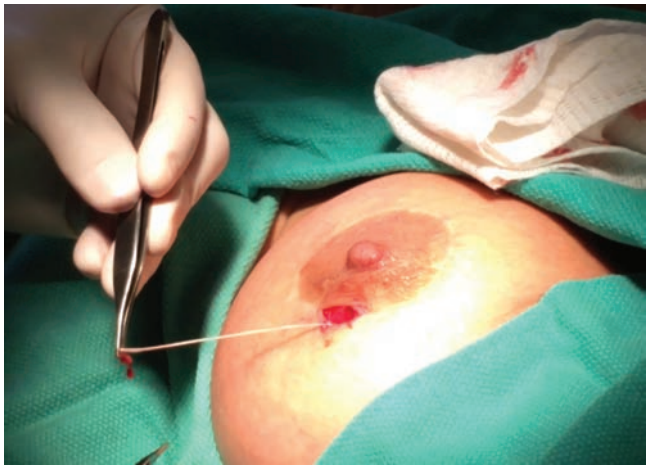
The overall complication rate was 32.9% of patients (Table 2) with an overall reoperation rate of 27.1% (Table 3). The most common indication for reoperation was issues related to the Gore-Tex suture, including persistent periareolar puckering (6/85, 7.1%), Gore-Tex suture failure (2/85, 2.4%), and Gore-Tex suture extrusion requiring removal (1/85, 1.2%). One of the challenges of periareolar augmentation-mastopexy is that the gathering effect of the interlocking periareolar suture inevitably causes some degree of skin puckering around the areola (Figure 4). In the majority of cases, this puckering settles over time. However, in cases where skin puckering persists, the permanent Gore-Tex suture may need to be removed. We typically do not remove the Gore-Tex suture earlier than 1 year postoperatively to help ensure stability of the periareolar

Table 2. Complications Among Patients Who Underwent Single-Stage Periareolar Mastopexy With Subglandular Breast Augmentation

Complication		Incidence (% of 85)
Implant-related	Capsular contracture	1 (1.2%)
	Seroma	2 (2.4%)
	Periprosthetic implant infection	3 (3.5%)
	Implant failure	1 (1.2%)
	Desired size change	2 (2.4%)
	Gore-Tex suture extrusion	1 (1.2%)
	Gore-Tex suture failure	2 (2.4%)
	Total	12 (14.1%)
Tissue-related	Tissue-related asymmetry	4 (4.7%)
	Wound healing delay/dehiscence	3 (3.5%)
	Persistent nipple-areola complex puckering	6 (7.1%)
	Superficial soft tissue infection	3 (3.5%)
	Total	16 (18.8%)
Grand total		28 (32.9%)

Table 3. Indications for Reoperation Among Patients Who Underwent Single-Stage Periareolar Mastopexy With Subglandular Breast Augmentation

Indication for reoperation		Reoperation rate (% of 85)
Implant-related	Capsular contracture	1 (1.2%)
	Seroma	2 (2.4%)
	Periprosthetic implant infection	3 (3.5%)
	Implant failure	1 (1.2%)
	Desired size change	1 (1.2%)
	Gore-Tex suture extrusion	1 (1.2%)
	Gore-Tex suture failure	2 (2.4%)
	Total	11 (12.9%)
Tissue-related	Tissue-related asymmetry	3 (3.5%)
	Wound healing delay/dehiscence	3 (3.5%)
	Persistent nipple-areola complex puckering	6 (7.1%)
	Total	12 (14.1%)
Grand total		23 (27.1%)



Video 2. Watch now at https://academic.oup.com/asj/articlelookup/doi/10.1093/asj/sjz128

scar. In our experience, when the Gore-Tex suture is removed after 1 year, the degree of NAC spreading is limited. This procedure is easily performed in an office setting under local anesthesia (Video 2). In cases where the Gore-Tex suture either extrudes or becomes infected, it must be removed. If this occurs earlier than 1 year postoperatively, it is important to warn patients that there may be some widening or flattening of the areola that may require later correction (Figure 5).

Implant-related complications were seen in 7 patients (8.2%). The most common complications were periprosthetic infection (3/85, 3.5%), seroma (2/85, 2.4%), implant rupture (1/85, 2.4%), and capsular contracture (1/85, 1.2%). All cases of implant-related complications occurred in patients with textured breast implants. Three patients required reoperation for issues related to wound healing/dehiscence (3.5%), and 4 patients underwent revision procedures for issues regarding breast aesthetics (4.7%). There were 3 cases of superficial wound infections (3.5%) that were managed with oral or intravenous antibiotics.

DISCUSSION

In our experience, periareolar augmentation-mastopexy is a safe and reliable procedure for single-stage correction of the hypoplastic breast with a mild to moderate degree of ptosis. However, not all patients are candidates for this procedure. The ideal candidate for periareolar augmentation-mastopexy has a tight inferior pole of the breast with limited horizontal laxity. In these patients, it can be difficult, if not impossible, to develop and reapproximate the vertical pillars commonly used in many short-scar mastopexy techniques. This becomes even more difficult once the breast implant is inserted and additional stretch is placed on the breast skin and parenchyma.

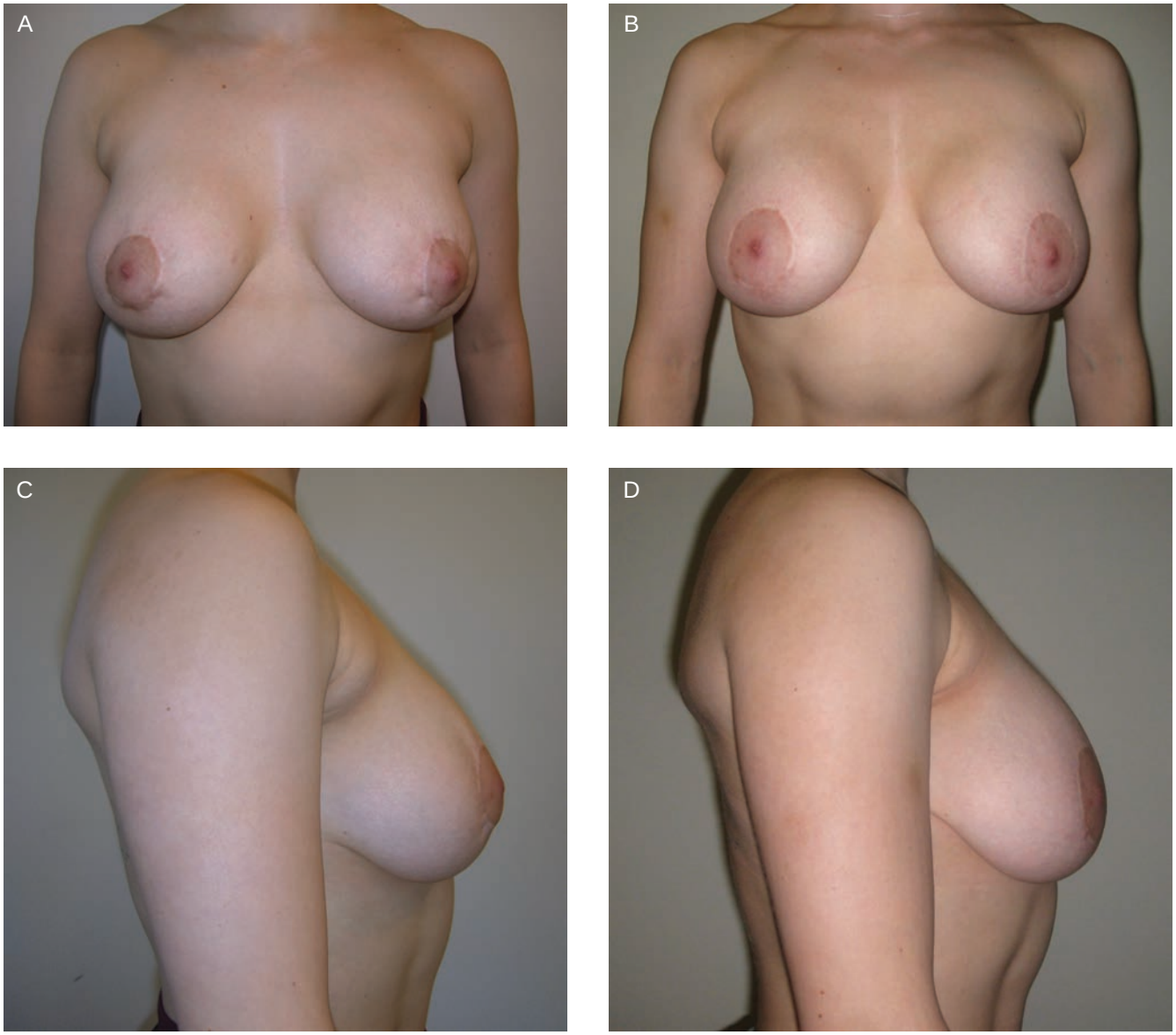


Figure 4. (A, C, E, G) This 25-year-old female who underwent a periareolar augmentation-mastopexy with 230-cc smooth round silicone gel implants and presented at 21 months postoperatively with concerns of persistent periareolar wrinkling and puffiness of the NAC. (B, D, F, H) Postoperative result at 12 months after removal of the Gore-Tex suture under local anesthetic demonstrates correction of periareolar wrinkling with no hypertrophy of the periareolar scar.

One interesting observation that we have made in our experience utilizing this technique is that the implant, once inserted into the subglandular pocket, exerts far greater stretch on the breast skin in the horizontal dimension than it does in the vertical dimension. It may be due in part to the fact that the natural ptosis of the breast has already stretched the breast in the vertical dimension. As a result of this differential soft-tissue recruitment over the breast implant, we believe it is critical to not only perform the augmentation portion of the procedure prior to committing to the mastopexy markings, but to also readjust the mastopexy markings once the implant has been inserted to confirm symmetry of the outer periareolar marking.

During the 8-year period of this retrospective study, our approach to implant selection changed. Whereas we typically employed more textured round implants earlier in this series, we now exclusively utilize smooth round implants for periareolar augmentation-mastopexy. As the literature regarding capsular contracture has developed, the role that subclinical infection and biofilms play in this process has become better defined.[25] With less surface area than textured implants, we believe that smooth implants can help to reduce the likelihood of bacterial

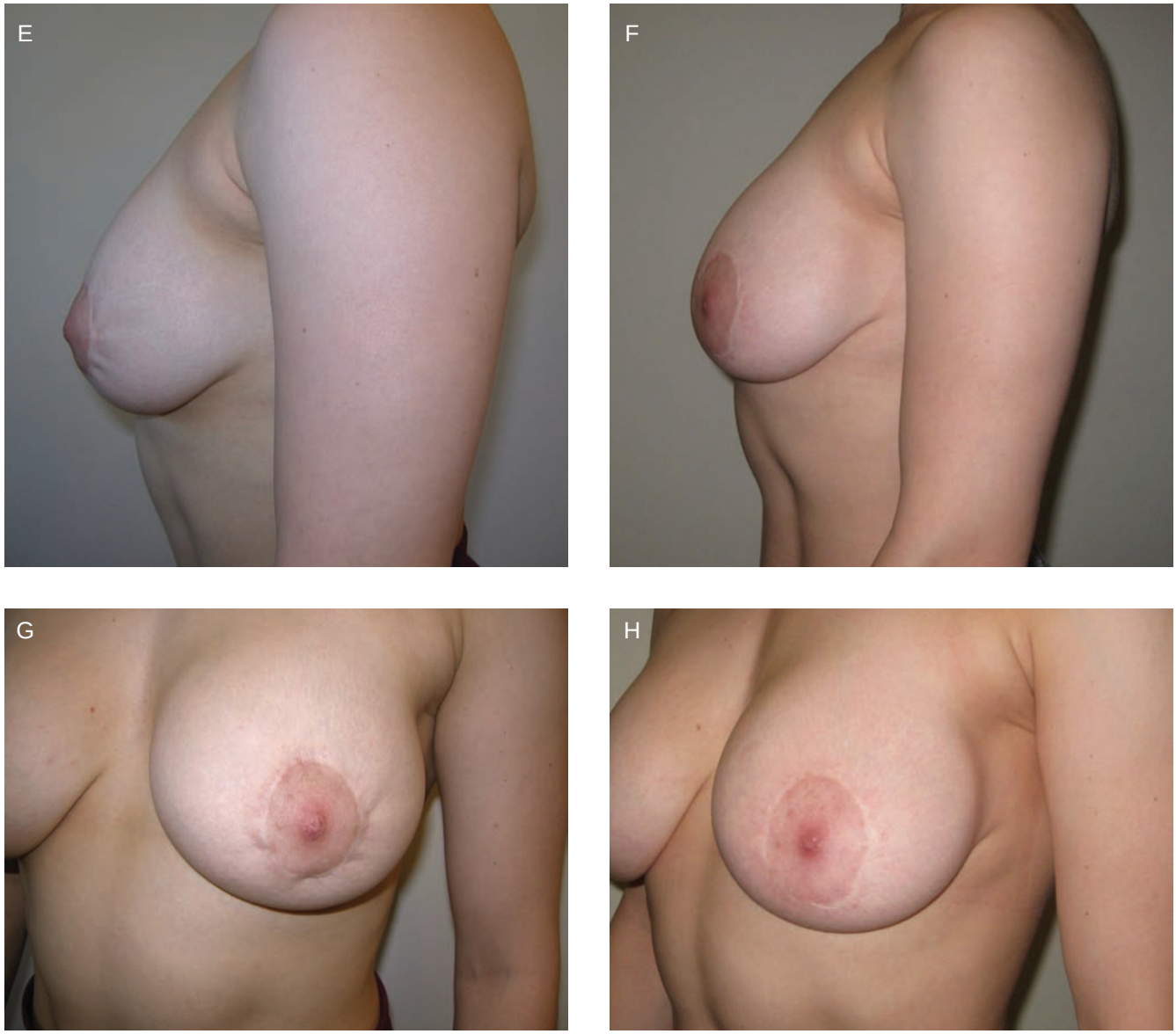


Figure 4. Continued

contamination and subsequent biofilm formation.[26-28] It has been our experience in both primary breast augmentation as well as primary augmentation-mastopexy that rates of capsular contracture are no different with smooth implants placed in a subglandular pocket compared with textured implants in a subglandular plane. Instead, we believe that the technique of implant insertion is much more important than either the implant surface or pocket selection. For this reason, we do not insert the implant through the periareolar incision; instead, we employ a separate inframammary crease incision to reduce the risk of bacterial contamination during implant insertion.[18,29,30] Furthermore, when employing the "no-touch" technique described above, we both minimize implant exposure to the outside environment and avoid any contact between the implant and the skin itself.[31] All of these steps, when combined together, have helped to maintain our low rate of capsular contracture in periareolar augmentation-mastopexy.

Implant placement in a subglandular pocket is also important to help achieve expansion of the lower pole of the breast. Through the separate inframammary crease incision, we are able to divide the superficial capsule of the breast under direct visualization, thus allowing the implant to more easily expand the tight lower pole of the breast. Based on our experience, we believe that smooth

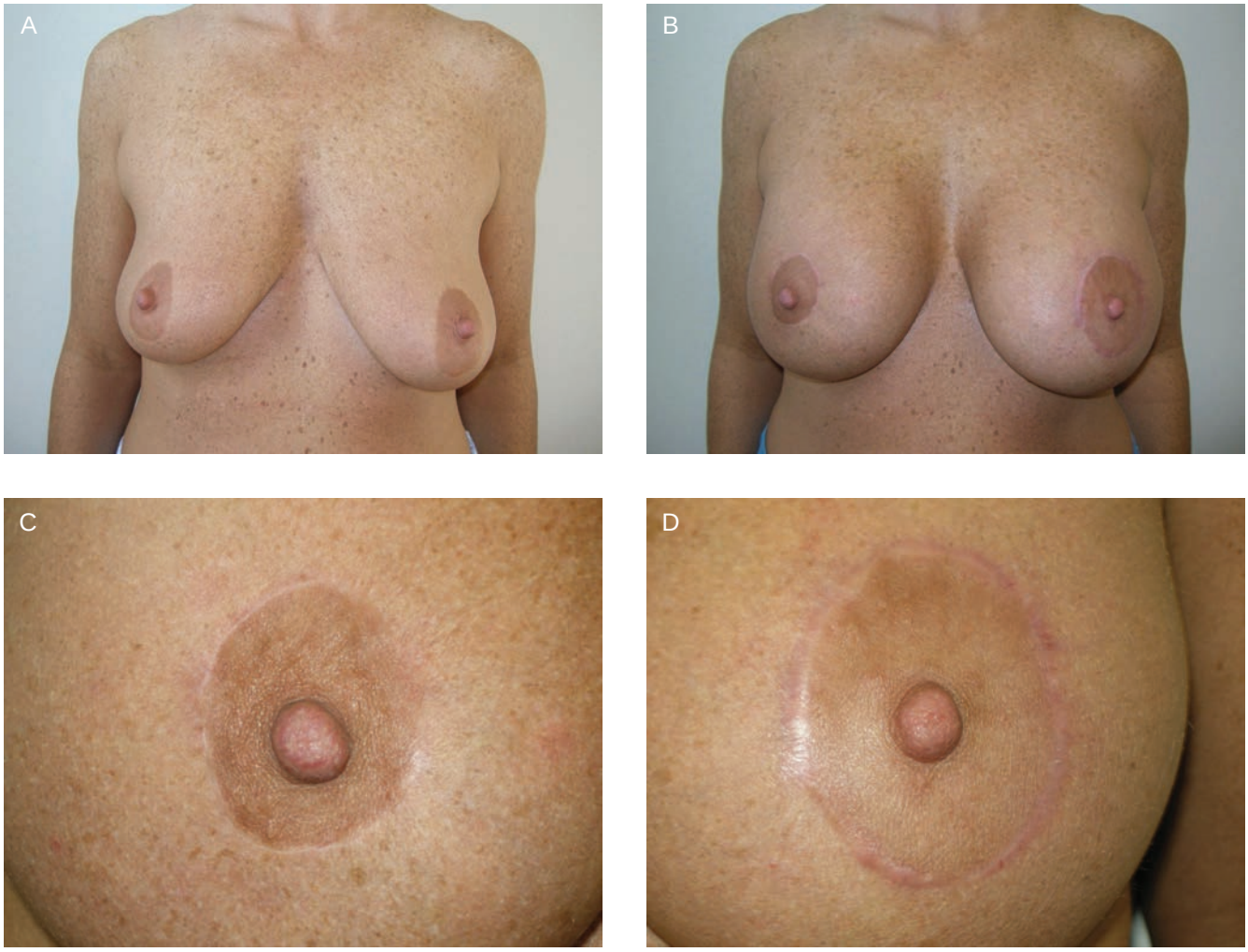


Figure 5. (A) Preoperative photograph of this 39-year-old female who presented for periareolar augmentation-mastopexy. Four months following periareolar augmentation mastopexy with 375-cc textured round silicone gel implants, the patient presented with failure of the permanent interlocking purse-string suture on the left side. (B) Photographs taken at 6 months postoperatively demonstrate the maintained nipple-areola complex diameter and mature periareolar scar on the intact right side (C) compared with the widened areola and hypertrophic periareolar scar on the left side (D).

implant placement in a subglandular pocket reduces the risk of inferolateral implant malposition that can be seen with subpectoral pocket placement. With the implant placed above the pectoralis major muscle, we avoid the repetitive "down and outward" force imparted onto the implant with regular contraction of the pectoralis major muscle.

It is important for both the patient and the surgeon to be aware of the potential complications associated with periareolar augmentation-mastopexy. Although several studies have documented the complication rates associated with single-stage augmentation-mastopexy procedures in general, few studies have looked specifically at periareolar augmentation-mastopexy.[2,3,32] Reported complication rates in single-stage periareolar augmentation-mastopexy range from 11% to 21.4%,[2,8,13,14,16,33] with reoperation rates ranging from 4% to 27%.[8,13,16,33-35] Commonly reported complications include NAC spreading, recurrent ptosis, hypertrophic scarring, and issues related to the breast implant/interlocking suture.

The complication rate of 32.9% in our cohort of 85 patients is higher than those figures previously reported in the literature. However, we feel that this is an accurate depiction of some of the subtle difficulties of this procedure (Table 2). The most common complications were tissue related, including persistent periareolar puckering (7.1%), asymmetry (4.7%), wound healing delay/dehiscence (3.5%), and superficial soft tissue infection (3.5%). Our reoperation rate of 27.1% is similar to figures previously reported in the literature (Table 3).[32,34] Although this figure may seem high, only 17.6% of patients required a return to the OR for reoperation, because nearly one-third

of revisions were performed as minor procedures under local anesthetic (ie, Gore-Tex suture removal for persistent periareolar puckering). In fact, we have fundamentally changed our view on persistent NAC puckering. We no longer view this as a true complication; instead we treat it as a "mini second-stage" procedure that is required in less than 10% of patients who underwent periareolar augmentation-mastopexy. We now explain this rationale to all patients before undergoing periareolar augmentation-mastopexy, which has been extremely helpful in the management of this concern.

CONCLUSIONS

In this article, we have attempted to describe some of the technical pearls and pitfalls that we have identified when performing periareolar augmentation-mastopexy in 85 patients during the past 8 years. Based on our experience, this is a safe and reliable technique for periareolar augmentation-mastopexy that, when performed in the appropriate patient, provides an excellent single-stage correction for the ptotic and hypoplastic breast.

Supplementary Material

This article contains supplementary material located online at www.aestheticsurgeryjournal.com.

Disclosures

The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

Funding

The authors received no financial support for the research, authorship, and publication of this article.

REFERENCES

1. Spear SL. Augmentation/mastopexy: "surgeon, beware". *Plast Reconstr Surg*. 2006;118:133S-134S.
2. Doshier LJ, Eagan SL, Shock LA, Henry SL, Colbert SH, Puckett CL. The subtleties of success in simultaneous augmentation-mastopexy. *Plast Reconstr Surg*. 2016;138(3):585-592.
3. Khavanin N, Jordan SW, Rambachan A, Kim JY. A systematic review of single-stage augmentation-mastopexy. *Plast Reconstr Surg*. 2014;134(5):922-931.
4. Castello MF, Silvestri A, Nicoli F, et al. Augmentation mammoplasty/mastopexy: lessons learned from 107 aesthetic cases. *Aesthetic Plast Surg*. 2014;38(5):896-907.
5. Gruber RP, Jones HW Jr. The "donut" mastopexy: indications and complications. *Plast Reconstr Surg*. 1980;65(1):34-38.
6. Benelli L. A new periareolar mammaplasty: the "round block" technique. *Aesthetic Plast Surg*. 1990;14(2):93-100.
7. Sterodimas A, Nicaretta B, Boriani F. Modified round block mastopexy versus traditional round block mastopexy. *Eur Rev Med Pharmacol Sci*. 2015;19(3):350-356.
8. Gonzalez R. The PAM method-periareolar augmentation mastopexy: a personal approach to treat hypoplastic breast with moderate ptosis. *Aesthet Surg J*. 2012;32(2):175-185.
9. Mottura AA. Periareolar mastopexy and augmentation. *Aesthet Surg J*. 2007;27(4):450-458.
10. Davison SP, Spear SL. Simultaneous breast augmentation with periareolar mastopexy. *Semin Plast Surg*. 2004;18(3):189-201.
11. de la Fuente A, Martín del Yerro JL. Periareolar mastopexy with mammary implants. *Aesthetic Plast Surg*. 1992;16(4):337-341.
12. Baran CN, Peker F, Ortak T, Sensöz O, Baran NK. Unsatisfactory results of periareolar mastopexy with or without augmentation and reduction mammoplasty: enlarged areola with flattened nipple. *Aesthetic Plast Surg*. 2001;25(4):286-289.
13. Franco J, Kelly E, Kelly M. Periareolar augmentation mastopexy with interlocking gore-tex suture, retrospective review of 50 consecutive patients. *Arch Plast Surg*. 2014;41(6):728-733.
14. Cárdenas-Camarena L, Ramírez-Macías R. Augmentation/mastopexy: how to select and perform the proper technique. *Aesthetic Plast Surg*. 2006;30(1):21-33.
15. Gasperoni C, Salgarello M, Gargani G. Experience and technical refinements in the "donut" mastopexy with augmentation mammaplasty. *Aesthetic Plast Surg*. 1988;12(2):111-114.
16. Cannon CL 3rd, Lindsey JT. Conservative augmentation with periareolar mastopexy reduces complications and treats a variety of breast types: a 5-year retrospective review of 100 consecutive patients. *Ann Plast Surg*. 2010;64(5):516-521.
17. Lista F, Doherty CD, Backstein RM, Ahmad J. The impact of perioperative warming in an outpatient aesthetic surgery setting. *Aesthet Surg J*. 2012;32(5):613-620.
18. Schwartz MR. Evidence-based medicine: breast augmentation. *Plast Reconstr Surg*. 2017;140(1):109e-119e.
19. Benito-Ruiz J. Nipple shields in transaxillary breast augmentation. *Ann Plast Surg*. 2017;78(4):397-402.
20. Khoo LS, Stevens HP. Preventing electrostatic contamination of breast implants: an effective and simple intraoperative method. *Aesthet Surg J*. 2017;37(6):731-733.
21. Mahabir RC, Peterson BD, Williamson JS, Valnicek SM, Williamson DG, East WE. Locally administered ketorolac and bupivacaine for control of postoperative pain in breast augmentation patients: part II. 10-day follow-up. *Plast Reconstr Surg*. 2008;121(2):638-643.
22. McCarthy CM, Pusic AL, Hidalgo DA. Efficacy of pocket irrigation with bupivacaine and ketorolac in breast augmentation: a randomized controlled trial. *Ann Plast Surg*. 2009;62(1):15-17.
23. Hammond DC, Khuthaila DK, Kim J. The interlocking Gore-Tex suture for control of areolar diameter and shape. *Plast Reconstr Surg*. 2007;119(3):804-809.

24. Righi B, Robotti E. Successfully exploiting two opposing forces: a rational explanation for the "interlocking suture". *Aesthetic Plast Surg*. 2011;35(2):177-183.
25. Ajdic D, Zoghbi Y, Gerth D, Panthaki ZJ, Thaller S. The relationship of bacterial biofilms and capsular contracture in breast implants. *Aesthet Surg J*. 2016;36(3):297-309.
26. Jacombs A, Tahir S, Hu H, et al. In vitro and in vivo investigation of the influence of implant surface on the formation of bacterial biofilm in mammary implants. *Plast Reconstr Surg*. 2014;133(4):471e-480e.
27. Barr S, Hill EW, Bayat A. Functional biocompatibility testing of silicone breast implants and a novel classification system based on surface roughness. *J Mech Behav Biomed Mater*. 2017;75:75-81.
28. Valencia-Lazcano AA, Alonso-Rasgado T, Bayat A. Characterisation of breast implant surfaces and correlation with fibroblast adhesion. *J Mech Behav Biomed Mater*. 2013;21:133-148.
29. Bartsich S, Ascherman JA, Whittier S, Yao CA, Rohde C. The breast: a clean-contaminated surgical site. *Aesthet Surg J*. 2011;31(7):802-806.
30. Jacobson JM, Gatti ME, Schaffner AD, Hill LM, Spear SL. Effect of incision choice on outcomes in primary breast augmentation. *Aesthet Surg J*. 2012;32(4):456-462.
31. Moyer HR, Ghazi B, Saunders N, Losken A. Contamination in smooth gel breast implant placement: testing a funnel versus digital insertion technique in a cadaver model. *Aesthet Surg J*. 2012;32(2):194-199.
32. Calobrace MB, Herdt DR, Cothron KJ. Simultaneous augmentation/mastopexy: a retrospective 5-year review of 332 consecutive cases. *Plast Reconstr Surg*. 2013;131(1):145-156.
33. Hickman DM. Application of the Goes double-skin peri-areolar mastopexy with and without implants: a 14-year experience. *J Plast Reconstr Aesthet Surg*. 2011;64(2):164-173.
34. Stevens WG, Freeman ME, Stoker DA, Quardt SM, Cohen R, Hirsch EM. One-stage mastopexy with breast augmentation: a review of 321 patients. *Plast Reconstr Surg*. 2007;120(6):1674-1679.
35. Mottura AA. Periareolar mastopexy and augmentation. *Aesthet Surg J*. 2007;27(4):450-458.