



INCISIONS & INSIGHTS



Technical Strategies for Improving Outcomes with MENTOR® ARTOURA™ Breast Tissue Expanders in Immediate Breast Reconstruction

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ABSTRACT

Two-stage tissue expander breast reconstruction represents a common and reliable method for breast reconstruction after mastectomy. Many strategies have been described to reduce complications and improve aesthetic results while other strategies remain anecdotal. In this manuscript we discuss some of the technical considerations for optimizing patient outcomes with the MENTOR® ARTOURA™ Breast Tissue Expander.

INTRODUCTION

The discipline of immediate breast reconstruction continues to evolve. In the last several years, surgeons have begun to critically evaluate their outcomes to develop new techniques that can optimize aesthetic results and decrease morbidity following mastectomy.^{1,2} In the last five years alone, we have seen an increase in innovative developments (such as direct-to-implant reconstruction, pre-pectoral tissue expansion and use of shaped, cohesive gel devices), which have heightened the awareness of plastic surgeons to critically evaluate their current techniques.^{3,4,5}

In light of these developments, two-stage tissue expander breast reconstruction remains the most common method for breast reconstruction following mastectomy.⁶ Reduction of complications of tissue expansion, particularly in the setting of post-mastectomy radiation, remain elusive for most

surgeons.^{7,8} There are peer-reviewed strategies in the literature that can feasibly reduce complications, particularly with regard to reducing surgical site infections.^{9,10} Nonetheless, other technique-based strategies are often shared among surgeons to assist with improving aesthetic outcomes throughout the stages of breast reconstruction. The development of the ARTOURA™ Breast Tissue Expander represents a paradigm shift in tissue expander design. Consequently, its success can depend on mastering technical considerations to optimize its intended usage.

In this paper, we discuss several clinical “pearls” that can potentially improve aesthetic outcomes and reduce complications with use of the ARTOURA Expander. We also discuss several potential “pitfalls” that can challenge the aesthetics of tissue expander reconstruction.

STRATEGIES FOR OPTIMAL ARTOURA™ BREAST TISSUE EXPANDER USAGE

#1 Maintaining Medial Pectoralis Attachments

During two-stage, submuscular breast reconstruction, the pectoralis serves as a vascularized “cover” over the upper portion of the tissue expander. This provides not only improvements in potential post-operative rippling of the implant, but provides a vascularized foundation for subcutaneous fat transfer during tertiary breast reconstruction.¹¹ The pectoralis must often be released along its inferior edge in order to accommodate a tissue expander (*Figure 1*).

In general, release of the pectoralis muscle above the tangential aspect of the sternum (i.e. 8 o’clock on the left side, 4 o’clock on the right side) can lead to significant secondary animation deformity (*Figure 2*). In these scenarios, reattachment of the pectoralis directly to the sternum during revision surgery is often not feasible due to muscular contraction, shortening, and loss of tension.

In order to prevent secondary traumatic rupture of the medial pectoralis attachments, the surgeon should often attempt to maintain the central and medial attachments in continuity with the medial edge of the rectus abdominus fascia (*Figure 3*). The thin transitioning layer of fascia from the pectoralis to the rectus can assist with maintaining muscle position and can also act as a scaffold if the surgeon were to utilize acellular dermal matrix (i.e. ADM) for soft-tissue support.

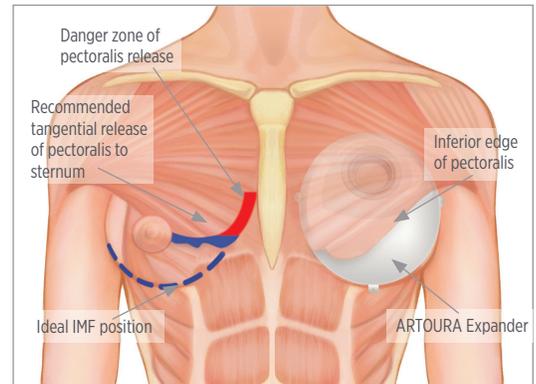


Figure 1
Position of the Pectoralis in Relation to Tissue Expander
The pectoralis muscle acts a vascularized “cover” over the upper portion of the tissue expander. The lower border of the pectoralis is released to accommodate space for the tissue expander. Release of the pectoralis above the tangential aspect of the sternum (i.e. “danger zone”) can lead to pectoralis malposition.

Figure 2: Pectoralis Animation Deformity

This patient underwent an extensive release of the pectoralis muscle during the initial tissue expander placement. At rest, the shape of her breast appears natural (A).

However, with muscle activation, the pectoralis creates a “window-shading” effect above the implant which can create a significant aesthetic deformity (B).

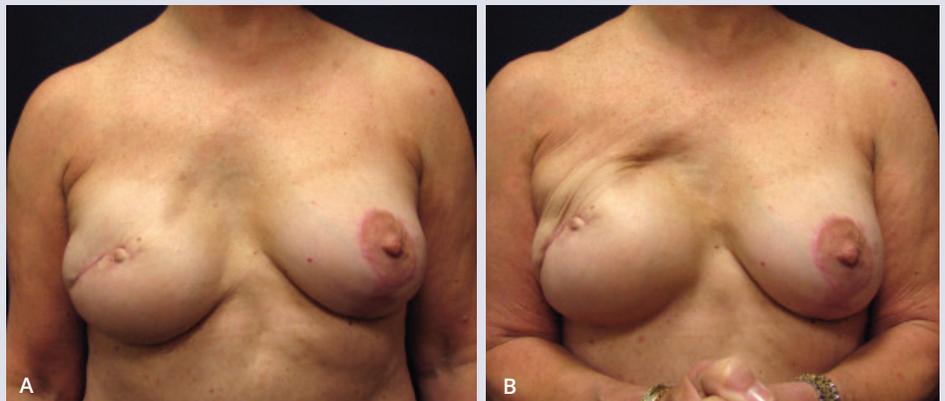
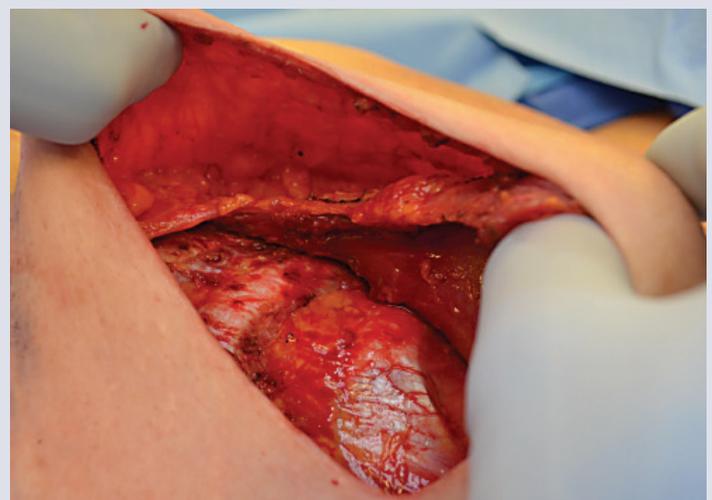


Figure 3: Maintaining Medial Pectoralis Attachments.

During pectoralis elevation, the medial pectoralis should be maintained in continuity with the rectus fascia. This will prevent a displacement or rupture of the pectoralis attachments.



#2 Pre-Filling of ARTOURA™ Breast Tissue Expander

Following the mastectomy, the soft tissue envelope can be thin, contracted or tight. Aggressive mastectomies can lead to tissue bruising and questionable viability of the skin flaps. Many surgeons will have a conservative tendency to avoid any higher volume fill of the expander as this can lead to pressure on the skin flap and potentially affect tissue perfusion.¹²

Any deflated expander will have sharply contoured edges that can potentially lead to undue pressure on the mastectomy skin flap (*Figure 4*). Post-operatively, it can require several sessions of expansion to completely “un-fold” the expander and return to a well contoured breast shape devoid of abrupt or sharp edges. If these edges are causing continued, point-directed pressure on marginal breast skin, the expander can extrude and eventually require explantation (*Figure 5*).

Pre-filling of the expander to a modest volume can successfully avoid folding and sharply contoured edges (*Figure 6A*). Positioning of the prefilled expander in the pocket, prior to closure will allow the surgeon to examine the expander to make certain that pressure from the pectoralis does not inadvertently cause any folding (*Figure 6B*). Prefilling the device also allows buttressing pressure to the ADM during its use for soft-tissue reinforcement of the mastectomy flap. This buttressing effect can significantly reduce the potential for dead space and potential seroma formation.

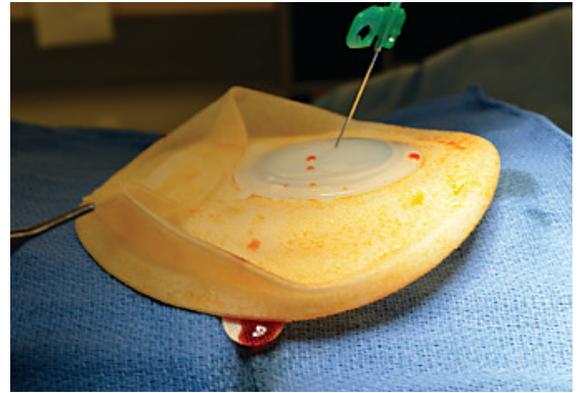


Figure 4: Deflated Tissue Expander
Any tissue expander, when deflated or partially inflated, will create a sharp edge or fold. Any of these edges can act as a sharp pressure point on the thin mastectomy skin flap.



Figure 5: Expander Extrusion

The sharp edges of an under-filled or deflated expander can create point-directed pressure on a mastectomy flap. If maintained with significant pressure, this can erode through the skin.

Figure 6: Prefilling of the ARTOURA Expander

Prefilling the expander to a desired capacity will inflate it to a volume that reduces any potential sharp or abrupt edge (A). After modest fill, the surgeon can manipulate the expander in the pocket to ensure that the device does not fold or kink in relation to the forces of the mastectomy pocket (B).



#3 Optimizing Tab Placement and Lateral Creep

During submuscular placement of the tissue expander, the inferior attachments of the pectoralis are usually released to accommodate space for the expander. If the expander is not anchored correctly, it can migrate laterally from the forces of pectoralis contraction. This phenomenon is referred to as lateral creep (Figure 7).

The use of suture tabs integrated into tissue expanders have been shown to reduce pocket malposition.¹³ There are several technical strategies to counter expander malposition. The first strategy involves special attention to medial tab placement. In my practice, I prefer to use a heavy 2-0 silk suture which is passed on the outside of the pectoralis from a medial to lateral direction. As the tab is sutured, the needle is passed backward 180 degrees as a horizontal mattress. This allows a solid grasping of the expander to be positioned against the sternum (Figure 8).

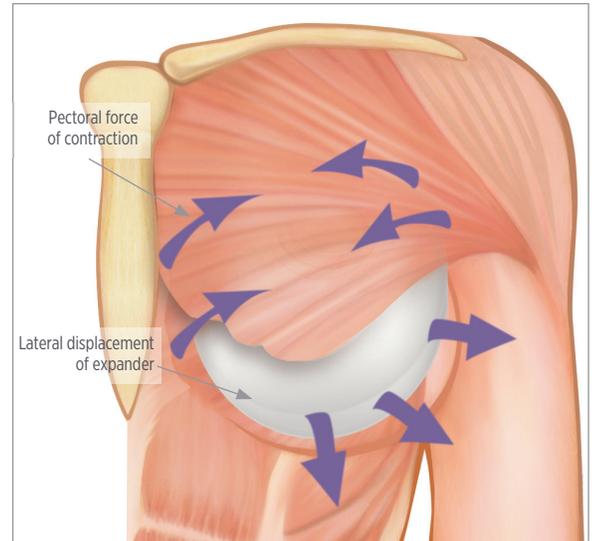
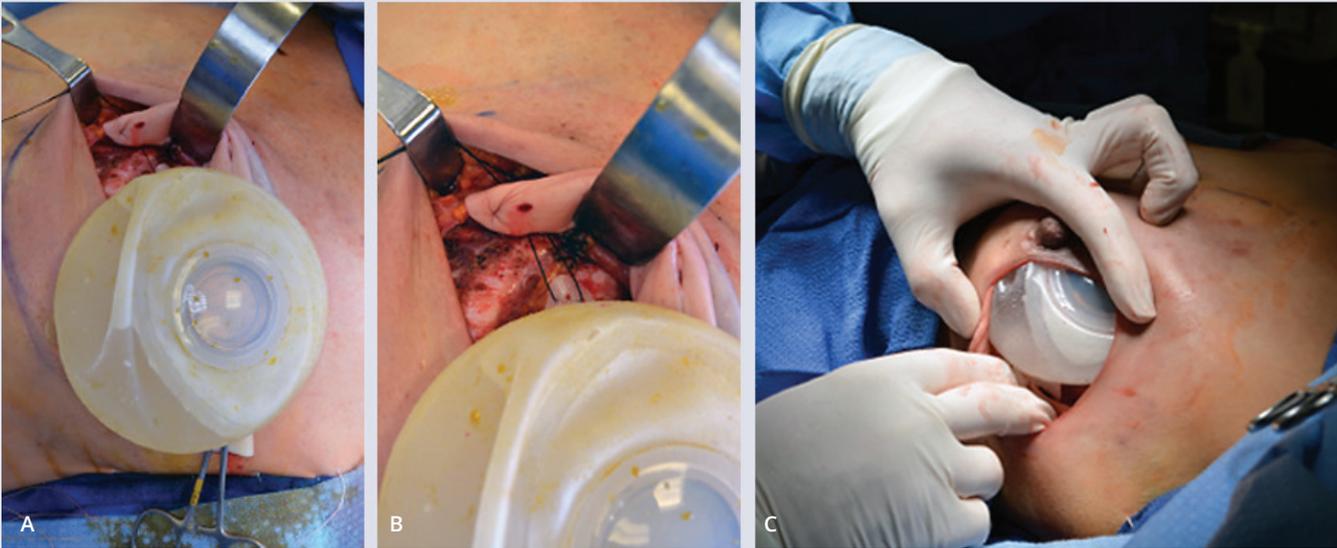


Figure 7: Expander Malposition and Lateral Creep

As surgeons attempt to maintain the medial attachments of the pectoralis muscle, this creates a phenomenon in which the expander has a tendency to migrate laterally on the chest wall. The forces of pectoralis contraction will act to place unopposed pressure on the tissue expander, causing it to migrate laterally during serial tissue expansion. The use of suture tabs on the expander can assist with reducing these tendencies.

Figure 8: Optimal Placement of Suture Tabs on the ARTOURA Expander

The use of the medial suture tab represents an opportunity to secure the expander under the pectoralis muscle to prevent lateral malposition. In the illustration, a 2-0 silk suture is utilized as a mattress suture passed toward the sternal edge of the pectoralis (A, B). The lateral tab should be placed flush against the chest wall while the expander is partially filled, in an effort to prevent expander folding (C).



In general, two or three tabs can be utilized. If the lateral tab is utilized, it should be contoured to fit against the chest wall. This prevents folding of the expander on to itself once the pectoralis muscle is re-draped.

Another strategy for preventing lateral creep involves the choice of expander width. The choice of a large expander which is beyond the width of the native breast will often predispose to lateral malposition. In general, the surgeon may wish to consider choosing an expander that is slightly narrower than the existing breast width. With the unique directional expansion offered by ARTOURA™ Breast Tissue Expanders, this lateral pocket position will be maintained. At the time of the implant exchange, it is often more predictable for the surgeon to slightly extend the pocket laterally through a small capsulotomy than to reduce a wide pocket through a capsulorrhaphy. If larger volume is desired, it may be more efficacious to choose an ultra-high profile ARTOURA Expander in preference to a high profile ARTOURA Expander. An illustration of these concepts is shown in Figure 9.

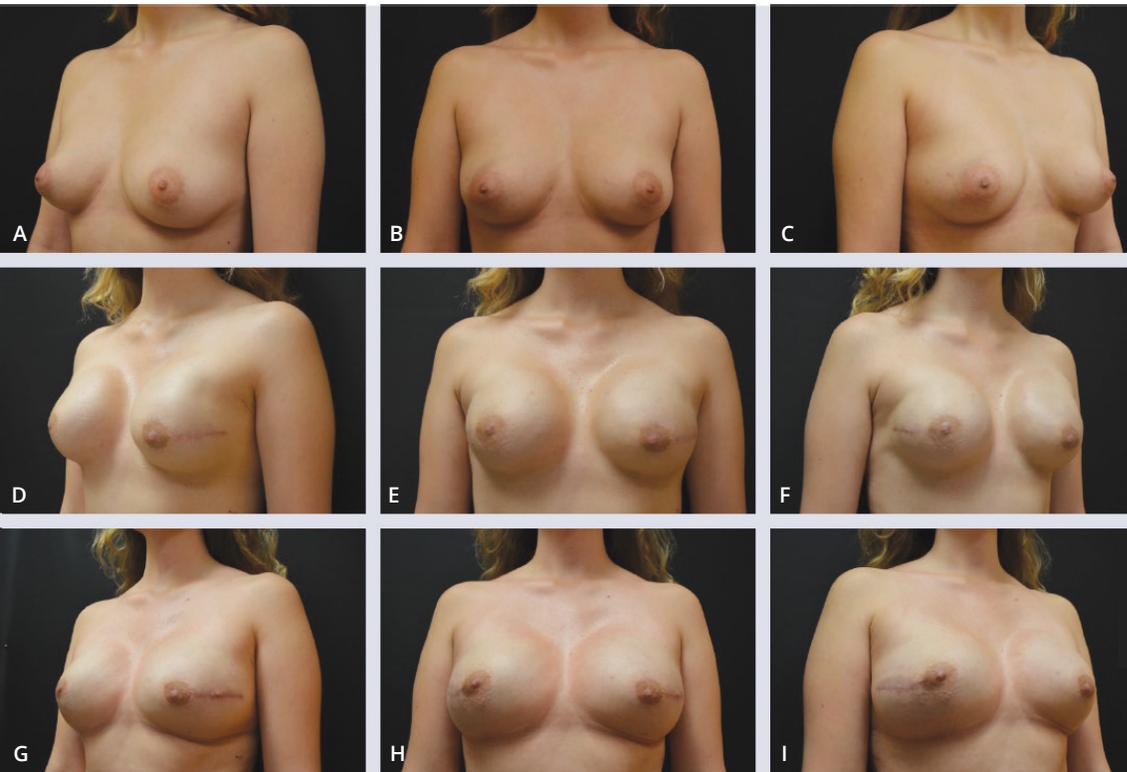


Figure 9: Clinical Case Illustration of Suture Tab Placement with an ARTOURA Expander

This 28 year-old patient was diagnosed with right sided breast cancer and opted for bilateral nipple-sparing mastectomies. Her preoperative photographs are illustrated (A-C). In preoperative discussion, she desired a larger, more-augmented appearance for her final result. Her initial breast width measured 11 cm. In order to prevent lateral creep, a smaller width expander (10 cm) was chosen. On the date of surgery, an Ultra-high profile 350cc ARTOURA Expander was placed with secure medial tab placement. A lateral tab was also utilized. Interim expansion to 325cc volume illustrates maintenance of medial expander position with no evidence of lateral malposition (D-F). A final postoperative view at 3 months illustrates the final result with 425cc Medium Height, High Profile (MH) MENTOR® MemoryShape® Breast Implants. (G-I)

#4 Re-Defining the Inframammary Fold

Whether incisions are placed mid-breast, or at the inframammary fold (IMF), the key to an aesthetic reconstruction involves preserving or redefining the IMF. In an ideal mastectomy, the natural attachments of the IMF are preserved. However in reality, these planes are often ablated during the oncologic resection.

ADMs have been shown to assist with soft tissue support for definition of the IMF.¹⁴ As the expander is filled with minimal capacity on the table, the surgeon can often utilize the ARTOURA™ Breast Tissue Expander to assist with fold definition. I often utilize a partial thickness bite of 2-0 PDS suture secured to the inner surface of the flap dermis approximated to the chest wall to assist with providing contour to the flap (*Figure 10*).

Mastectomies performed through an IMF incision provide an anatomic definition of the IMF for suture control. Poor attention to reconstruction of this anatomic landmark can lead to a blunted-appearing IMF which looks very unnatural (*Figure 11*).

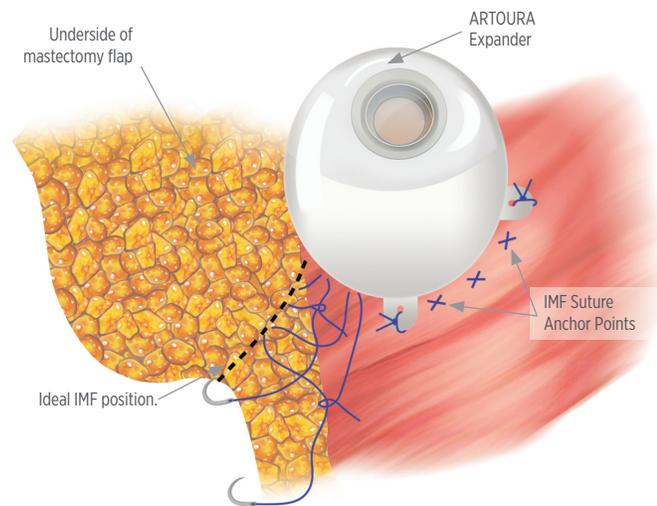


Figure 10: Suture Techniques for Re-Defining the Inframammary Fold

Oncologic removal of the breast often involves disruption of the IMF. In order to reconstruct the IMF, dermal sutures can be utilized to redefine the concavity of the fold. These are secured to the chest wall and contoured to the expander.

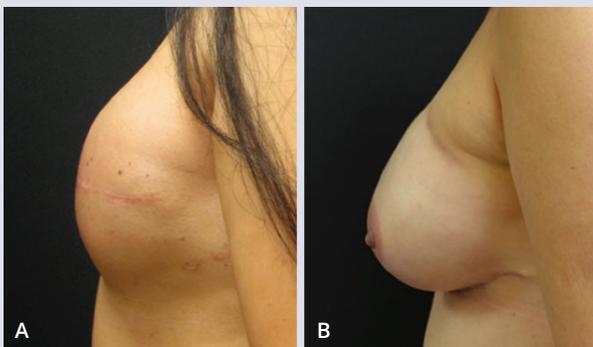


Figure 11: Inframammary Fold Deformity Following Mastectomy and Tissue Expansion

The natural soft tissue attachments of the IMF can often become ablated during aggressive mastectomies. If these attachments are not reconstructed, tissue expansion can lead to a blunted, poorly-defined IMF which appears unaesthetic (A). Securing subdermal sutures from the IMF to the chest wall, particularly following inframammary incisions can recreate an aesthetic IMF (B).

#5 Avoidance of Seroma and Infection

There are several evidence-based strategies to reduce the incidence of surgical site infection in prosthetic breast reconstruction.¹⁵ These include use of chlorohexidine-based washes, skin preparation, timing of intravenous antibiotic administration and reduction of seroma formation. The mastectomy skin pocket creates a significantly large potential space for seroma formation. Placement of multiple foreign bodies in this pocket (i.e. tissue expanders, ADM, suture) inherently creates an opportunity for seroma formation. Seromas create a significant risk for soft tissue and expander pocket infection.¹⁶

Strategies to reduce seroma formation include making certain that little space exists between the skin pocket and the tissue expander. If an ADM is used, it should have a tight approximation to the undersurface of the skin flap. Maximizing expander filling on the table, while not compromising skin perfusion, can assist in this regard.

Liberal and extended use of drains is also a necessary evil to prevent seroma formation. Drain harpoons can allow the placement of the drain interface to be tunneled several centimeters from the mastectomy pocket (*Figure 12*). This can theoretically reduce the translocation of bacteria along the drain tunnel.

Many patients will concomitantly have a sentinel node biopsy performed at the same operative sitting as the mastectomy. It is often preferable to place the hub of the drain near the axilla closest to the exit point of the breast pocket as (opposed to the leading point of the drain). This will ensure that seroma fluid from the axilla does not “pass-over” near the expander pocket along the drain, potentially leading to greater contamination of the implant pocket.

A central line dressing or BIOPATCH® Protective Disk with CHG device can theoretically create a bacteriostatic “halo” around the drain site to reduce potential bacterial growth along the tract, however this effect has not been demonstrated in the literature.¹⁷ I prefer to seal the drain site closed with an occlusive IV dressing which prevents the drain from “pistoning” or being pulled in a different direction.

Most often, surgical site infections are acquired from normal skin flora in which a surgical incision creates an entry point. After the incision is closed in the operating room, I prefer it to remain sealed and avoid any dressing change until the first postoperative visit. A DERMABOND® PRINEO® Skin Closure System dressing sealed below a large and expansive occlusive dressing can create an impervious incision that avoids any potential manipulation prior to the skin healing (*Figure 13*).

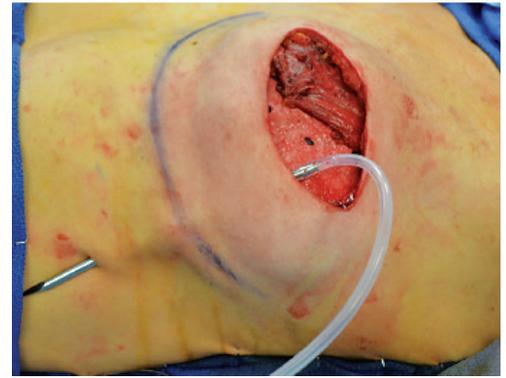


Figure 12: Drain Placement with ARTOURA Expander

In general, drains will tend to reduce the potential for dead space around the expander. A drain harpoon can be utilized to tunnel the drain several centimeters below the existing breast pocket.



Figure 13: Dressings and Skin Treatment with ARTOURA Expander

The drain site represents a potential for bacteria translocation. A BIOPATCH® Protective Disk with CHG can potentially reduce skin microbe contamination along the drain tract. A standard intravenous line dressing can be utilized as an anchor to prevent drain manipulation or disruption. Occlusive dressings and/or DERMABOND® PRINEO® Skin Closure System placement can potentially “seal” the wound during postoperative healing.



CONCLUSION

Optimizing patient outcomes and aesthetic results during tissue expander breast reconstruction is a paramount goal for every patient and surgeon alike. The development of the MENTOR® ARTOURA™ Breast Tissue Expander represents a new generation for directional tissue expansion of the breast pocket following mastectomy. Successful use of outcome strategies and best practices can be critical in obtaining an aesthetic breast reconstruction.

REFERENCES

1. De Vita, Roy M.D.; Zoccali, Giovanni M.D.; Buccheri, Ernesto Maria M.D.; Costantini, Maurizio M.D.; Botti, Claudio M.D.; Pozzi, Marcello M.D. Outcome Evaluation after 2023 Nipple-Sparing Mastectomies: Our Experience *Plastic & Reconstructive Surgery* 139 (2): 335e-347e, February 2017.
2. Sinha, Indranil; Pusic, Andrea L.; Wilkins, Edwin G.; Hamill, Jennifer B.; Chen, Xiaoxue; Kim, Hyungjin M.; Guldbrandsen, Gretchen; Chun, Yoon S. Late Surgical-Site Infection in Immediate Implant-Based Breast Reconstruction. *Plastic & Reconstructive Surgery* 139(1):20-28, January 2017.
3. Clarke-Pearson, Emily M.; Lin, Alex M.; Hertl, Catherine; Austen, William G.; Colwell, Amy S. Revisions in Implant-Based Breast Reconstruction: How Does Direct-to-Implant Measure Up. *Plastic & Reconstructive Surgery* 137(6):1690-1699, June 2016.
4. Sigalove, Steven; Maxwell, G. Patrick; Sigalove, Noemi M.; Storm-Dickerson, Toni L.; Pope, Nicole; Rice, Jami; Gabriel, Allen. Prepectoral Implant-Based Breast Reconstruction: Rationale, Indications, and Preliminary Results. *Plastic & Reconstructive Surgery* 139(2):287-294, February 2017.
5. Caplin, David A. Indications for the Use of MemoryShape Breast Implants in Aesthetic and Reconstructive Breast Surgery: Long-Term Clinical Outcomes of Shaped versus Round Silicone Breast Implants. *Plastic & Reconstructive Surgery* 134(3S):27S-37S, September 2014.
6. Albornoz, Claudia R.; Bach, Peter B.; Mehrara, Babak J.; Disa, Joseph J.; Pusic, Andrea L.; McCarthy, Colleen M.; Cordeiro, Peter G.; Matros, Evan. A Paradigm Shift in U.S. Breast Reconstruction: Increasing Implant Rates. *Plastic & Reconstructive Surgery* 131(1):15-23, January 2013.
7. Hirsch, Elliot M.; Seth, Akhil K.; Kim, John Y. S.; Dumanian, Gregory A.; Mustoe, Thomas A.; Galiano, Robert D.; Fine, Neil A. Analysis of Risk Factors for Complications in Expander/Implant Breast Reconstruction by Stage of Reconstruction. *Plastic & Reconstructive Surgery* 134(5):692e-699e, November 2014.
8. Kronowitz SJ, Robb GL. Radiation therapy and breast reconstruction: A critical review of the literature. *Plastic & Reconstructive Surgery* 124:395-408, 2009
9. Francis, Stacey H.; Ruberg, Robert L.; Stevenson, Kurt B.; Beck, Catherine E.; Ruppert, Amy S.; Harper, Justin T.; Boehmler, James H. IV; Miller, Michael J. Less Independent Risk Factors for Infection in Tissue Expander Breast Reconstruction. *Plastic & Reconstructive Surgery* 124(6):1790-1796, December 2009.
10. Cohen, Justin B.; Carroll, Cathy; Tenenbaum, Marissa M.; Myckatyn, Terence M. Breast Implant-Associated Infections: The Role of the National Surgical Quality Improvement Program and the Local Microbiome. *Plastic & Reconstructive Surgery* 136(5):921-929, November 2015.
11. Hammond, Dennis C.; O'Connor, Elizabeth A.; Scheer, Johanna R. Total Envelope Fat Grafting: A Novel Approach in Breast Reconstruction. *Plastic & Reconstructive Surgery* 135(3):691-694, March 2015.
12. Crosby, Melissa A.; Dong, Wenli; Feng, Lei; Kronowitz, Steven J. Effect of Intraoperative Saline Fill Volume on Perioperative Outcomes in Tissue Expander Breast Reconstruction. *Plastic & Reconstructive Surgery* 127(3):1065-1072, March 2011.
13. Spear, Scott L.; Economides, James M.; Shuck, John; Patel, Ketan M. Analyzing Implant Movement with Tabbed and Nontabbed Expanders through the Process of Two-Stage Breast Reconstruction. *Plastic & Reconstructive Surgery* 133(3):256e-260e, March 2014.
14. Spear, Scott L. M.D.; Sher, Sarah R. M.D.; Al-Attar, Ali M.D., Ph.D.; Pittman, Troy M.D. Applications of Acellular Dermal Matrix in Revision Breast Reconstruction Surgery. *Plastic & Reconstructive Surgery* 133(1):1-10, January 2014.
15. Harrison, Bridget; Khansa, Ibrahim; Janis, Jeffrey E. Evidence-Based Strategies to Reduce Postoperative Complications in Plastic Surgery. *Plastic & Reconstructive Surgery* 138(3S):51S-60S, September 2016.
16. Jordan, Sumanas W.; Khavanin, Nima; Kim, John Y. S. Seroma in Prosthetic Breast Reconstruction *Plastic & Reconstructive Surgery* 137(4):1104-1116, April 2016.
17. Weichman, Katie E.; Clavin, Nicholas W.; Miller, Helen C.; McCarthy, Colleen M.; Pusic, Andrea L.; Mehrara, Babak J.; Disa, Joseph J. Does the Use of Biopatch Devices at Drain Sites Reduce Perioperative Infectious Complications in Patients Undergoing Immediate Tissue Expander Breast Reconstruction? *Plastic & Reconstructive Surgery* 135(1):9e-17e, January 2015.

DISCLAIMER:

This white paper includes a demonstration of the use of a surgical device; it is not intended to be used as a surgical training guide. Other surgeons may employ different techniques. The steps demonstrated may not be the complete steps of the procedure. Individual surgeon preference and experience, as well as patient needs, may dictate variation in procedure steps. Before using any medical device, including those demonstrated or referenced in this white paper, review all relevant package inserts, with particular attention to the indications, contraindications, warnings and precautions, and steps for use of the device.

IMPORTANT SAFETY INFORMATION:

MENTOR® MemoryGel® Breast Implants, MENTOR® MemoryShape® Breast Implants, and MENTOR® Saline-filled Breast Implants are indicated for breast augmentation in women (at least 22 years old for MemoryGel® Implants and MemoryShape® Implants, and 18 years old for Saline Implants) or for breast reconstruction. Breast implant surgery should not be performed in women with active infection anywhere in their body, with existing cancer or pre-cancer of their breast who have not received adequate treatment for those conditions, or who are currently pregnant or nursing.

Breast implants are not lifetime devices and breast implantation may not be a one-time surgery.

The most common complications for breast augmentation and reconstruction with MemoryGel® Implants include any reoperation, capsular contracture, and implant removal with or without replacement. The most common complications with MemoryShape® Implants for breast augmentation include reoperation for any reason, implant removal with or without replacement, and ptosis. The most common complications with MemoryShape® Implants for breast reconstruction include reoperation for any reason, implant removal with or without replacement, and capsular contracture. A lower risk of complication is rupture. The health consequences of a ruptured silicone gel breast implant have not been fully established. MRI screenings are recommended three years after initial implant surgery and then every two years after to detect silent rupture.

The most common complications with MENTOR® Saline-filled Implants include reoperation, implant removal, capsular contracture, breast pain, and implant deflation.

For MemoryGel® Implants, patients should receive a copy of *Important Information for Augmentation Patients about MENTOR® MemoryGel® Breast Implants* or *Important Information for Reconstruction Patients about MENTOR® MemoryGel® Breast Implants*. For MemoryShape® Implants, patients should receive a copy of *Patient Educational Brochure – Breast Augmentation with MENTOR® MemoryShape® Breast Implants* or *Patient Educational Brochure – Breast Reconstruction with MENTOR® MemoryShape® Breast Implants*, and a copy of *Quick Facts about Breast Augmentation & Reconstruction with MENTOR® MemoryShape® Breast Implants*. For MENTOR® Saline-filled Implants, patients should receive a copy of *Saline-Filled Breast Implants: Making an Informed Decision*. Your patient needs to read and understand the information regarding the risks and benefits of breast implants, with an opportunity to consult with you prior to deciding on surgery.

The ARTOURA™ Breast Tissue Expander or CONTOUR PROFILE® Breast Tissue Expander can be utilized for breast reconstruction after mastectomy, correction of an underdeveloped breast, scar revision, and tissue defect procedures. The expander is intended for temporary subcutaneous or submuscular implantation and is not intended for use beyond six months. Do not use the ARTOURATM Tissue Expander nor CONTOUR PROFILE® Tissue Expander in patients where an MRI may be needed. The device could be moved by the MRI causing pain or displacement, potentially resulting in a revision surgery. The incidence of extrusion of the expander has been shown to increase when the expander has been placed in injured areas.

For detailed indications, contraindications, warnings, and precautions associated with the use of all MENTOR® Implantable Devices, which include MENTOR® Saline-filled Implants, MemoryGel® Implants, MemoryShape® Implants, ARTOURA™ Expanders, and CONTOUR PROFILE® Expanders, please refer to the Product Insert Data Sheet provided with each product or visit www.mentorwwllc.com.