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Breast Cancer Surgery and the Principles of Oncoplastic Surgery

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CHAPTER XVI

IMMEDIATE ONE-STAGE VERSUS TWO-STAGE EXPANDER BREAST RECONSTRUCTION

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Currently, implant-based breast reconstruction is the most commonly performed primary reconstruction following mastectomy, 90 % of which are by the tissue expansion technique. According to the American Society of Plastic Surgeons 2012 Statistics Report, 70.5 percent of all breast reconstructions are achieved using expanders [1,2]. The procedure has been greatly facilitated by the wide acceptance of skin sparing mastectomy (SSM) as a safe oncologic procedure since larger skin envelope with normal color and texture can be maintained to support immediate reconstruction. The technique is also popular because of its apparent reliability, safety, simplicity, reduced scarring, and avoidance of additional donor-site morbidity [3]. Moreover, the speed of the technique makes it an attractive option with shorter hospital stay and a quicker recovery compared to autologous breast reconstruction procedures. It remains also the method of choice because it does not delay adjuvant treatment or mask the detection of local recurrences [2].

Classically, expander based breast reconstruction has been performed in a two-stage procedure; an expander is placed in a total sub-muscular pocket in the first stage with initiation of inflation at 10 to 14 days postoperatively. In this second operation the expander is replaced with an implant, the muscle is released and an infra-mammary fold reconstructed. Recently, immediate reconstruction with single-stage permanent implant/expander placement has become more popular [4,5] with patients having to undergo only one operation avoiding further general anesthesia, and associated additional cost. The target expansion size and shape can be readily adjusted by subsequent inflations and deflations [1,3,6,7].

Hilton Becker [8] was the first to describe the permanent tissue expander-silicone gel breast implant combination with a detachable filling reservoir in 1984. Permanent expanders are designed with the objective of combining the advantages of the silicone gel implant, saline implant, and tissue expander into one thus allowing single stage reconstruction. At present, various types of permanent expanders round or anatomical teardrop, smooth or textured, and with various silicone and saline fill volumes are available (table 1).

Mentor® BECKER™ Expander/Breast Implants
SILTEX™ Round BECKER™ 25 Expander/Breast Implants, Cohesive I™ 25% Silicone Gel, Cohesive I™, in outer lumen, 75% Saline in inner lumen
SILTEX™ Round BECKER™ 50 Expander/Breast Implants, Cohesive I™ 50% Silicone Gel, Cohesive I™, in outer lumen, 50% Saline in inner lumen
SILTEX™ CONTOUR PROFILE™ BECKER™ 35 Expander/Breast Implants, Cohesive II™ 35% Silicone Gel, Cohesive II™, in outer lumen, 65% Saline in inner lumen
Mentor® SPECTRA™ Adjustable Gel Breast Implants **Allows injection of a small volume of saline**
SILTEX™ Round SPECTRA™ Adjustable Gel Implants, Cohesive I™
Smooth Round SPECTRA™ Adjustable Gel Implants, Cohesive I™
Mentor® SPECTRUM™ Postoperatively Adjustable Saline Breast Implants
Smooth Round SPECTRUM™ Implants
SILTEX™ Round SPECTRUM™ Implants
SILTEX™ CONTOUR PROFILE™ SPECTRUM™ Implants
Natrelle™ 150 Anatomical Permanent Expanders Full and short Height

Table 1: Currently available permanent expanders.

For any given patient, expander size is determined preoperatively by chest wall and breast measurements, however, there are no well-defined guidelines for choosing the proper expander shape, surface texture, gel cohesiveness, or the optimal proportion of silicone gel

and saline volumes. The early permanent expanders either the round (Becker™ 25 and 50) or the first anatomical device available for one-stage implant-based immediate breast reconstruction (McGhan Style 150, now Natrelle™ 150), were reported to have several drawbacks resulting in high revisional surgery rates. The round implants cause excessive fullness of the upper poles, unnatural rounded shape, and poor lower pole projection; the only available anatomical expandable implant had a firm cohesive gel and was not designed for over-inflation or injection port removal. To address some of these problems and with the belief that anatomical permanent expander/implants may provide a better breast shape than the unshaped round implants or expanders, improvements in both design and architecture were made. Becker™ 35 expanders were introduced in 2004. The device is teardrop shaped and its outer compartment contains soft cohesive silicone gel allowing preferential expansion of the lower pole and 25% overexpansion when required [3,7].

Post-mastectomy breast reconstruction using round Becker adjustable saline implants is well established. At present the bi-lumen adjustable gel-saline Becker™ 35 implant is gaining rapidly in popularity and is becoming an accepted prosthesis for single-stage immediate and delayed breast reconstruction as well as for other procedures such as aesthetic breast augmentation and correction of congenital anomalies. The device is reported as a reliable implant associated with low complication and high retention rates with good to excellent results. It is approximately 1.8 times more expensive than conventional tissue expanders or fixed volume silicone implants; nevertheless, compared with the cost of a single-stage reconstruction, a two-stage reconstruction increases subsequent costs by a factor of 1.5 [6,7,8,9].

For single stage breast reconstruction, the permanent expander is traditionally inserted always aiming for full muscle coverage. The pectoralis major muscle is raised together with the serratus anterior laterally to provide lateral implant cover. The inferior pectoralis major muscle is also detached from the ribs and raised either together with the abdominal fascia or together with the deep subcutaneous layer above the abdominal fascia so as to provide complete expander

coverage. When used in conjunction with latissimus dorsi (LD) reconstruction, expanders are sandwiched between the pectoralis muscle and the LD flap. The expander is prepared by aspirating any air from the saline bladder. It may be positioned in the pocket totally deflated or partially filled with saline solution. Further filling may then be performed as allowed by the pocket size and skin flap vascularity. Final implant fill is accomplished on an outpatient basis. Some mention that optimum breast shape is best achieved by initial expansion of the permanent expander on the operating table then deflating it keeping on the average 10% of the filling volume. Filling of the expander is then completed at outpatient visits. Expanders with textured surface are designed to promote tissue adherence theoretically reducing the likelihood of implant migration and capsular contracture but they must be filled to the recommended fill volume to prevent rippling [2,6,7]. Becker [4] mentions that textured saline implants ripple more than smooth implants and that the textured shell is less elastic which encourages superior migration and fixation of the implant.

Despite described favorable results with single-stage expander breast reconstruction [6], some reported long-term outcomes have been somehow disappointing. Progressive deterioration of the initial aesthetic result with distortion and asymmetry over the course of time is frequent due to aging of the patient in particular the contralateral breast parenchyma and progressive deterioration of the implants. Natural aging of the overlying skin envelope and overall weight change in patients are also likely to influence long-term outcome [10,11]. Clough et al. [11] reported deterioration in aesthetic outcome after implant-based immediate breast reconstruction from an 86% acceptable result at 2 years to 54% at 5 years. Implant removal rates of 14% and 21% between 5 and 9 years have been reported. Recently, Chew et al. [9] reported an explantation rate of permanent expanders (round and anatomically shaped) of more than 68% within 5 years of positioning with the expander 'half-life' being only 30 months. By 10 years, this rate is 90% indicating that ultimately the technique does not appear to meet the design objective of providing a true single stage reconstruction. In the final analysis, permanent

expanders seemed to be used in many patients as regular expanders for two-stage reconstructive strategy raising serious questions regarding both clinical and cost effectiveness [2,9,12,13].

The majority of complications usually occur in the first 18 months following reconstruction. Important variables associated with a high risk of complications leading to permanent expander removal include radiotherapy, high BMI, older age, and reconstruction performed by less-experienced surgeons. Contrary to other previous reports, chemotherapy, tobacco consumption, presence of concomitant diseases, inflation percentage of the expander, or the type of permanent expander used do not seem to be important contributing factors associated with the occurrence of complications in relation to the survival of Becker-type implants [10]. Some complications leading to explantation are common and similar to any breast implant including severe capsular contracture, infection, unacceptable aesthetic result, implant extrusion, haematoma, rupture, dislocation and skin necrosis. Others are peculiar to permanent expanders such as filling port dislocation, filling port failure, pain on expansion, tube detachment, valve obstruction, rippling and wrinkling [13]. Claims that permanent expanders had to be exchanged for fixed-volume implants in a second surgical procedure in the majority of patients because of poor aesthetics and shape asymmetries are common [2]. In one study, 50% of Becker expanders had to be removed within 30 months for poor aesthetics (23.5%), adverse capsular contracture (17.6%) and infection (16.2%) [8]. In another study, 70% of women were not satisfied with the final result of one-stage reconstruction, compared with only 10% of the two-stage approach. Patients were mostly dissatisfied with upper pole fullness and poor ptosis [2,9,12].

Surprisingly, better results and lower long-term explantation rates have been reported when Becker expanders have been used to correct congenital hypoplasias or when used for breast reconstruction in conjunction with LD flap. These findings led to the conclusion that healthy soft tissues surrounding the implant are necessary to achieve long-lasting single-stage breast reconstruction with permanent expanders [2,9,12]. In fact, the same can be said for any type of

implant and any alloplastic reconstruction strategy. A critical evaluation of these reported results indicates that there is a major difference in the implantation pocket. For correction of congenital hypoplasia or for breast reconstruction in conjunction with LD flap, in contradistinction to described implant/expander breast reconstruction, the device is not placed in a sub-pectoral pocket with complete muscle coverage. In fact after completion of expansion with the two-stage procedure, the muscle is released inferiorly and an infra-mammary fold is reconstructed while replacing the expander with a permanent implant.

The Becker implant is a permanent expander; once positioned, it cannot be adjusted at a later date, as in two-stage expander/prosthesis reconstructions [13]. Thus for one-stage operation, whether using a Becker implant or a gel implant, it is imperative that the infra-mammary fold be reconstructed at this stage and secured to the chest wall. The pectoralis major muscle has to be completely released inferiorly and then secured to prevent superior migration [4]. In retrospect, poor results reported by some with the one-stage Becker implant reconstruction are due to improper surgical technique and inadequate implantation pocket, not to expander characteristics. Moreover, when preparing the expander by aspirating any air from the saline bladder, it is critical to ensure that the implant foot-print is not distorted before inserting it in the prepared pocket to secure that the final expanded implant is in the proper position particularly if expansion is started as generally recommended only after appropriate wound healing.

It must be noted that variations in expansion protocols and the nature of surface texturing of various available implants can lead to observable modifications in peri-prosthetic capsular architecture. Siltex™ (Mentor Worldwide, Santa Barbara, Calif.) texturing is a patterned surface created as a negative contact imprint of a texturing foam while Biocell® Natrelle™ 150 (Allergan, Inc., Irvine, Calif.) surface is a more aggressive open-pore textured surface created using a lost-salt technique that increases the depth of depressions and creates stilted edges. Based on the fact that a mature scar capsule

requires at least 4 weeks to form, it has been hypothesized that delaying initiation of postoperative serial expansion may permit improved capsular tissue adherence into the textured expander implant shell and, ultimately, leads to a safer and more predictable expansion process. In fact a delay of 6 weeks results in superior tissue adherence with clinically observable Velcro effect with the Biocell® textured surface implants only and has no measurable effect on the Siltex™ textured implants; the peri-prosthetic capsule never truly adheres to this type of textured shell [1].

Irrespective of the ongoing debate about the value of surface texturing and the recent controversy regarding association of anaplastic large cell lymphoma with the more aggressive surface texturing, we do not feel that implant-capsular tissue adherence is a pre-requisite for safer expansion. On the contrary, with firm adherence, expansion results in micro-motions and a mechanical shearing effect at the implant-capsule interface that may amplify the inflammatory process triggering more fibrosis with an increased risk of double capsule and seroma formation and potentially promoting peri-prosthetic biofilm formation. Moreover, the implant instead of settling down to produce better lower pole projection tends with the Velcro effect to be dragged along with the expansion process more pronounced superiorly particularly if the implant is placed entirely in a sub-muscular pocket.

With proper design of mastectomy flaps and doubling of the suture line by a de-epithelialized dermal flap, we believe that there is no need to wait 2 weeks or more before initiation of expander inflation. Very early inflation within few days postoperatively at shorter intervals is possible and can be performed safely. This reduces the risk of implant caudal migration and allows better lower pole projection and infra-mammary fold definition (fig. 1, and 2).

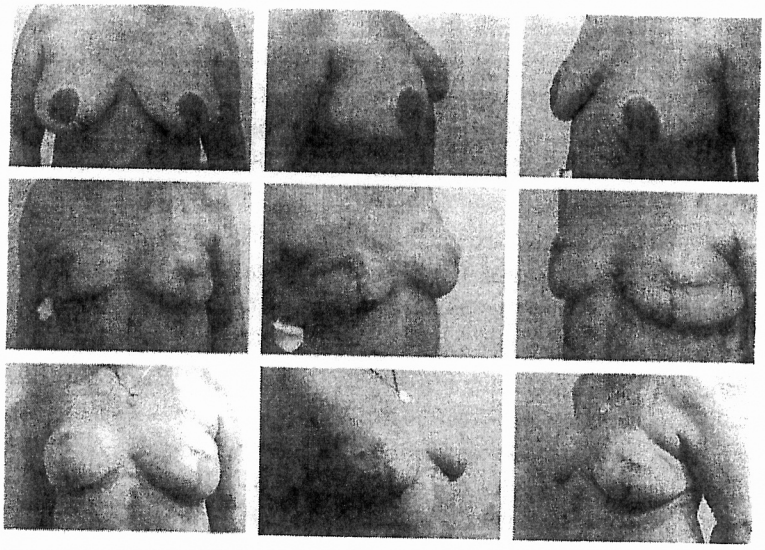

Fig. 1: (top row) 60 y old patient (28.5 BMI) with previous aesthetic breast surgery presented with right intra-ductal carcinoma. After preoperative neo-adjuvant chemotherapy she had bilateral skin reducing mastectomy, right axillary lymph node dissection, and reconstruction with Becker™ 35 Expander/Implant, Cohesive II™ (365 cc: 125 cc silicone + 240 cc saline). 50 cc saline installed at the time of surgery then expansion with 50 cc performed at 3 days interval. (midle row) Over-inflation (300 cc saline) completed 20 days postoperatively when right axillary drain was removed. (bottom row). Result at 6 weeks postoperatively.

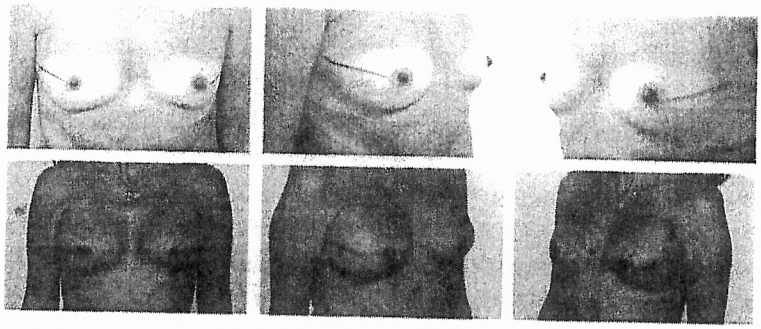

Fig. 2: 54 y old patient (18.3 BMI) with left breast lobular carcinoma; wished to have larger reconstructed breasts. Following left nipple-areola sparing mastectomy and right prophylactic mastectomy reconstruction with expander, Becker™ 35 Expander/Implant, Cohesive II™ (325 cc: 110 cc silicone + 215 cc saline), placed in a dual plane pocket; infra-mammary fold reconstructed initially. Expansion completed within 2 weeks. Result at 3 months just after removal of expansion port.

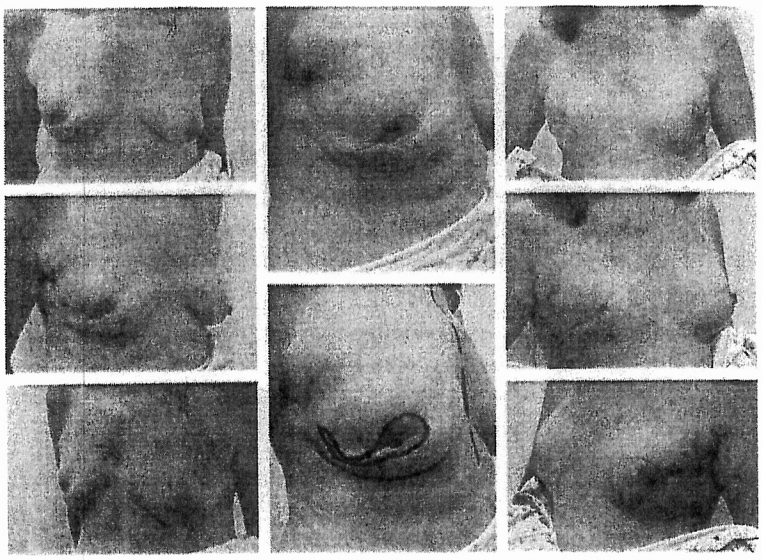

Fig. 3: 58 y old patient (25.9 BMI) following lumpectomy of 2 lesions of the right breast requiring right skin sparing completion mastectomy and left nipple sparing mastectomy. Immediate bilateral breast reconstruction performed with Becker™ 35 Expander/Implant, Cohesive II™ (290 cc: 100 cc silicone + 190 cc saline) breast reconstruction. Expansion was completed within 2 weeks postoperatively and inflation ports removed at 3 weeks.

There is no one-size-fits-all approach to breast reconstruction. Although autologous tissue breast reconstruction has some long-term advantages, women may still choose to avoid complex surgery and prefer an implant-based immediate breast reconstruction. However, compared to the one-stage expander reconstruction, claiming that the two-stage expander method gives the breast a more natural shape with the highest objective and subjective scores is not very appropriate. A bio-dimensional permanent expander implant, when used appropriately, can achieve high levels of patient satisfaction [14]. The upper pole fullness and lack of ptosis commonly observed with the one-stage permanent expander is mostly due to the erroneous implantation pocket. Even though the debate over the role of Becker expander/implant in breast reconstruction is still ongoing and there are no clear indications for its use, we believe, same as others, that this device deserves its place in breast reconstruction but

must be used only by surgeons well experienced in breast reconstruction [8,13] (fig. 3).

Despite the fact that in some cases secondary surgery may be required to improve breast contour, the rate of second surgery with permanent Becker expander/implant is definitely less than the 100% rate with the two-stage approach. Moreover, in many secondary corrections, minor scar revision or fat transfer may be all what is required; the expander/implant can be maintained and does not need to be replaced by gel prosthesis (fig. 4, 5 and 6).

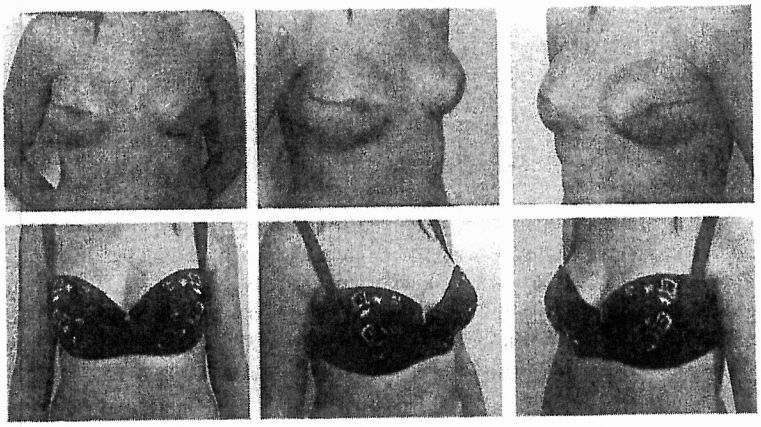

Fig. 4: 29 y old patient (21 BMI) 3 1/2 months following bilateral skin-sparing mastectomy and immediate Becker™ 35 Expander/Implant, Cohesive II™ (325 cc: 110 cc silicone + 215 cc saline) breast reconstruction. Expansion was completed within 3 weeks postoperatively. At 2 months injection ports were removed and fat transfer performed to blunt the upper implants border.

Fig. 5: Same patient 1 year postoperatively after nipple-areola reconstruction.

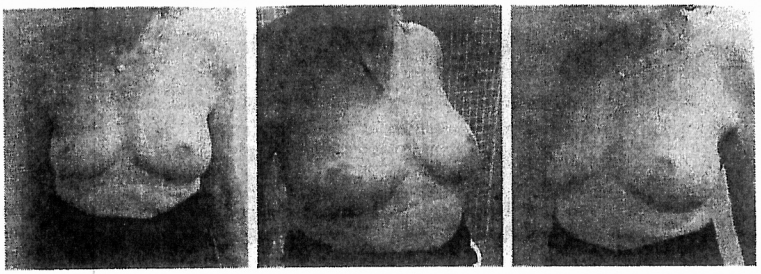

Fig. 6: 72 y old patient with left breast tumor; 2 years following bilateral areola sparing (nipple excised) and immediate breast reconstruction with Becker™ 35 Expander/Implant, Cohesive II™ (290 cc: 100 cc silicone + 190 cc saline) with good IMF definition and lower pole fullness. Left medial upper contour could be improved with lipofilling but patient was satisfied with result.

RFERENCES:

1. Paek LS, Giot JP, Tétreault-Paquin JO, St-Jacques S, et al. The impact of postoperative expansion initiation timing on breast expander capsular characteristics: a prospective combined clinical and scanning electron microscopy study. Plast Reconstr Surg. 2015; 135:967-974.
2. Eriksen C, Lindgren EN, Frisell J, Stark B. A prospective randomized study comparing two different expander approaches in implant-based breast reconstruction: one stage versus two stages. Plast Reconstr Surg. 2012; 130:254e-264e.
3. Hsieh F, Shah A, Malata CM. Experience with the Mentor Contour Profile Becker-35 expandable implants in reconstructive breast surgery. J Plast Reconstr Aesthet Surg. 2010; 63:1124-1130.
4. Becker H. A prospective randomized study comparing two different expander approaches in implant-based breast reconstruction: one stage versus two stages. Plast Reconstr Surg. 2013; 131:643e-644e.
5. Farace F1, Faenza M, Bulla A, Rubino C, Campus GV. Is mammary reconstruction with the anatomical Becker expander a simple procedure? Complications and hidden problems leading to secondary surgical procedures: a follow-up study. J Plast Reconstr Aesthet Surg. 2013; 66:741-746.
6. Goh SC1, Thorne AL, Williams G, Laws SA, Rainsbury RM. Breast reconstruction using permanent Becker expander implants: an 18 year experience. Breast. 2012; 21:764-768.
7. Scuderi N1, Alfano C, Campus GV, Rubino C, Chiummariello S, Puddu A, Mazzocchi M. Multicenter study on breast reconstruction outcome using Becker implants. Aesthetic Plast Surg. 2011; 35:66-72.
8. Becker H. The expandable mammary implant. Plast Reconstr Surg. 1987; 79:631-637.

9. Chew BK1, Yip C, Malyon AD. Becker expander implants: truly a long term single stage reconstruction? J Plast Reconstr Aesthet Surg. 2010; 63:1300-1304.
10. Taboada-Suarez A, Brea-García B, Magán-Muñoz F, Couto-González I, et al. Risk Factors Associated With Complication Rates of Becker-Type Expander Implants in Relation to Implant Survival: Review of 314 Implants in 237 Patients. Ann Plast Surg. 2014 Jul 4. [Epub ahead of print].
11. Clough KB, O'Donoghue JM, Fitoussi AD, Nos C, Falcou MC. Prospective evaluation of late cosmetic results following breast reconstruction: I. Implant reconstruction. Plast Reconstr Surg. 2001; 107: 1702-1709.
12. Sindali K, Davis M, Mughal M, Orkar KS. The natural history of Becker expandable breast implants: a single-center 10-year experience. Plast Reconstr Surg. 2013; 132: 345e-351e.
13. Farace F, Faenza M, Bulla A, Rubino C, Campus GV. Is mammary reconstruction with the anatomical Becker expander a simple procedure? Complications and hidden problems leading to secondary surgical procedures: a follow-up study. J Plast Reconstr Aesthet Surg. 2013; 66:741-746.
14. Gui GP, Kadayaprath G, Tan SM, Faliakou EC, et al. Long-term quality-of-life assessment following one-stage immediate breast reconstruction using biodimensional expander implants: the patient's perspective. Plast Reconstr Surg. 2008; 121:17-22.