



SERI Surgical Scaffold as an Adjunct for Circumferential Abdominoplasty and Lower Body Lift

Andrew Kornstein, MD, FACS

Summary: Patients who have undergone massive weight loss typically have poor-quality skin and fascia and thus are prone to experiencing recurrent skin laxity, bulges, and poor scarring after body contouring efforts, even in the hands of experienced surgeons. Moreover, this challenging patient population often has nutritional deficiencies and concomitant medical problems, which may lead to delayed or suboptimal wound healing. A silk-derived biological scaffold (SBS) and its facilitation of autogenous tissue generation may be viewed as a qualitative reinforcement of the superficial fascial system. Therefore, it may help support and stabilize a superficial fascial system that has been weakened by obesity and other factors. When employed in body lifting for patients with massive weight loss who desire long-lasting aesthetic results, it may represent a paradigm shift that has the potential to solve at least some issues that plague this patient population. In the present case of circumferential abdominoplasty and lower body lift, this silk-based bioresorbable scaffold was implanted in one side of the patient's body but not the other. Throughout the 7-month follow-up period, the patient and her husband (who were blinded as to which side received the SBS) and the author consistently observed more favorable results for the SBS side, which included greater postoperative comfort, better shape, higher buttock position, less recurrent laxity, and less descent of the scar. (*Plast Reconstr Surg Glob Open* 2014;XXX:00-00; doi: 10.1097/GOX.0000000000000214; Published online Day Month 2014.)

Surgical body contouring is commonly required to address the skin and soft tissues that are excessive in quantity but deficient in quality in patients who have undergone massive weight loss. Moreover, estrogen-deficient patients (men and postmenopausal women) may have a qualitative healing disadvantage.¹⁻³ Understanding the anatomic

and pathologic changes relating to age, weight, and possibly estrogen deficiency may help guide surgical reconstruction. For example, obesity influences the quality of the superficial fascial system (SFS).⁴ With increased adiposity, the layers of the SFS become more dilute and indistinct. Moreover, aging and sun damage also weaken the SFS, via a stress relaxation

From the Museum Mile Surgery Center, New York, N.Y.

Received for publication September 11, 2014; accepted September 16, 2014.

Copyright © 2014 The Authors. Published by Lippincott Williams & Wilkins on behalf of The American Society of Plastic Surgeons. PRS Global Open is a publication of the American Society of Plastic Surgeons. This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives 3.0 License, where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially.

DOI: 10.1097/GOX.0000000000000214

Disclosure: Dr. Kornstein is in private practice in New York City, N.Y., where he is Director of the Museum Mile Surgery Center. He is also a member of Split Rock Surgical Associates in Wilton, Conn. This study was funded by Allergan, Irvine, Calif., at the request of the investigator. Allergan was not involved in the development of the article. Neither honoraria nor payments were made for authorship by Allergan. The Article Processing Charge was paid for by the author.

phenomenon, resulting in gravitational cellulite and enlarged and ptotic adipose bulges.

Redundant skin in the trunk and thigh is typically treated by circumferential abdominoplasty and lower body lift.⁵ This surgery can help correct functional and aesthetic problems, resulting in a rejuvenated appearance for patients with lax ptotic tissue.⁶⁻⁸ However, body contouring for patients with massive weight loss is unlike routine cosmetic surgery.⁶ This complex population often has nutritional deficiencies, concomitant medical issues, poor skin quality, and suboptimal wound healing and scarring.^{6,7,9}

Achieving long-term correction of certain deformities in these patients, such as saddlebags, can be challenging. Although bulging and sagging skin of the lateral thigh may appear vastly improved immediately following the surgery, such problems may partially recur shortly afterward. To this end, some investigators have resorted to more aggressive resection using full abduction when marking the resection of thigh tissue along with high-tension closure of the subcutaneous fascial system.⁸ However, this approach may create other issues, such as poor contour and impaired healing.

Providing improved-quality soft tissue during the body lift procedure, especially for the SFS, may obviate the excess tension that accompanies the abduction-marking technique. In other words, improving the quality of the “sculpting clay” with which surgeons must work may minimize recrudescence of skin laxity and deformities (such as saddlebags), which in turn may expedite wound healing and improve scar quality. The desired aesthetic and functional outcomes could be attained earlier, and their longevity is maximized.

A silk-derived biological scaffold (SBS) (SERI Surgical Scaffold; Allergan, Irvine, Calif.) may serve as a strengthening adjunct to body lift surgery. Cleared by the US Food and Drug Administration in November 2008, SERI is indicated for use as a transitory scaffold for soft-tissue repair and support.¹⁰ This multifilament mesh-like material is derived from silk that has been purified by the BIOSILK process (Allergan), yielding ultrapure fibroin.

The SBS is designed to reinforce areas of deficiency where laxity and/or weakness exist,¹⁰ such as the SFS. After implantation, the scaffold is replaced by the body's native tissue. It is slowly bioresorbed, in parallel to neovascularization and native tissue ingrowth, resulting in eventual replacement with native tissue. During bioresorption, load-bearing responsibility is transferred to the new tissue ingrowth, allowing maintenance of mechanical integrity at the surgical site.¹⁰

The efficacy of this SBS has been demonstrated in aesthetic and reconstructive breast surgery, abdominal wall repair, and one other patient who underwent circumferential body lift after massive weight

loss, with high rates of physician and patient satisfaction.¹¹⁻¹³ Moreover, the author of the present report has used this scaffold successfully for soft-tissue support in conventional brachioplasty.¹⁴

The following case vignette demonstrates the technique and benefits of SBS as an adjunct to body lift surgery. It represents the first application of this product to a case of inpatient control for any indication.

CASE PRESENTATION

This 39-year-old, 5'2" woman previously lost 100 lb through dieting and exercise and is now a triathlete. Her weight at consultation was 120 lb. She presented with pan body laxity, most obvious in the breast, buttock, and thigh, and desired body contouring surgery. On December 6, 2013, she underwent thigh/buttock lift with rotation flap autologous buttock augmentation.^{15,16} (Augmentation-mastopexy was performed concurrently.) Preoperative and postoperative clinical photographs are shown in Figure 1 (lateral views; postoperative right image has been reversed for demonstrative purposes).

In light of the SBS's favorable clinical record¹¹⁻¹³ and theoretical advantages for circumferential body lift surgery, this adjunct device was recommended to the patient. Both she and her husband (a physician) consented to incorporate the scaffold into the procedure and have it applied unilaterally. The SBS was interposed on the patient's left side, between layers of the SFS. The right side served as the control and underwent standard technique and closure. It was agreed preoperatively that if any asymmetry was detected between the 2 sides postoperatively, contralateral implantation of the SBS would be performed. Both the patient and her husband were blinded as to which side received the SBS.

Implantation of the SBS

Before closure of the posterior truncal incision, the SBS was implanted in the patient's left side, in accordance with the manufacturer's instructions.¹⁰ (Note that this product is not indicated for patients with a known allergy to silk.) A single layer of the scaffold was interposed between the surgically opposed SFS edges using a no. 1 Tevdek (Teleflex, Limerick, Pa.) figure-of-8 suture. Intraoperative photographs and an illustration of the surgical technique appear in Figures 2 and 3.

Results and Follow-up

After the early postoperative period, the patient had monthly follow-up visits. At all visits, the patient and her husband correctly identified the SBS side, although they remained blinded to this throughout the follow-up period. Their observations ranged from

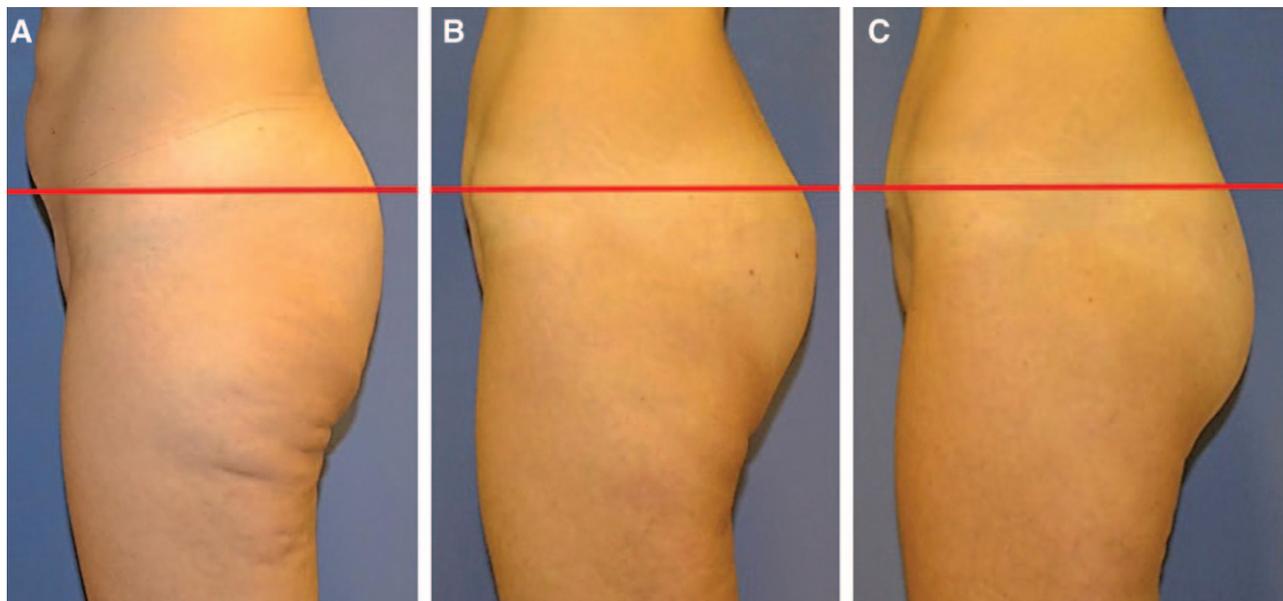


Fig. 1. Preoperative and postoperative images of the patient. A, preoperative left lateral view. B, left lateral view 11 months postoperatively (SBS side). C, right lateral view (reversed) 11 months postoperatively. Note: the red line joins the anterior superior iliac spines; postoperative scars have been removed to highlight the contour discrepancy.

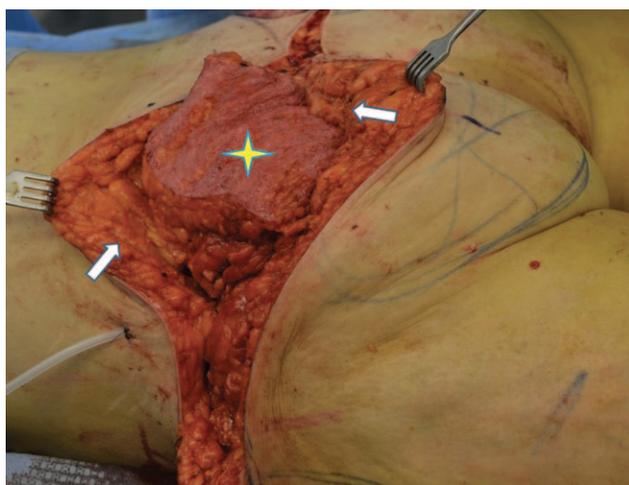


Fig. 2. Intraoperative view of the left buttock shows the depithelialized flap fashioned from posterior truncal redundancy (star), rotated into position as an autogenous “buttock implant.” Arrows indicate cut edges of the superficial fascial system at the defect border.

better shape and higher buttock position to greater comfort and less laxity with exercise. Although all of the patient’s scars remain equally hypertrophic at 7 months postoperatively (likely due to damaged dermal collagen and/or deficient circulation from her 100-lb weight loss), the SBS side looks and feels better according to the patient, her husband, and the surgeon. Moreover, virtually all buttock elevation and projection have been maintained (Fig. 4). The scar has descended further on the non-SBS side, which also demonstrates more outer and pos-

terior skin laxity of the thigh. Although it is too early for any revisional surgery, the potential timing for contralateral SBS implantation to permit enhanced long-term symmetry is being considered actively, per the mutual preoperative agreement.

Figure 4 shows a side-by-side comparison of the durability of the patient’s body lift and buttock augmentation, in which the only difference in technique was the interposition of the SBS on the patient’s left side during the SFS reconstruction. The yellow line indicates her preoperative silhouette, the red line reflects the appearance 1 month postoperatively, and the black line shows her appearance at 7 months. The disparity between the left and right sides was initially observed approximately 5 months after the surgery.

DISCUSSION

Skin and soft-tissue redundancy of the trunk and thigh, which is common after massive weight loss, is often treated by circumferential abdominoplasty and lower body lift.⁵ Contemporary body lifting was popularized by Lockwood.^{4,5} His surgical concepts are based on anatomic research showing that suspension of the SFS is an essential aspect of body contouring surgery of the trunk and extremities.⁴ The SFS encases, supports, and shapes the fat and holds skin onto underlying tissues. Eliminating redundancy of the SFS, which is common in body contouring procedures, serves various purposes: it diffuses tension on the skin flap, effectively lifts areas of soft-tissue ptosis, and provides

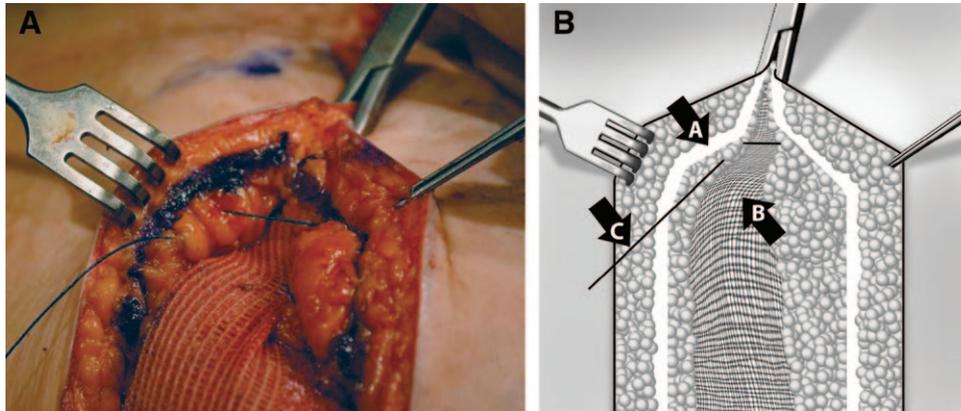


Fig. 3. Intraoperative (A) and illustrative (B) images depict incorporation of the SBS at closure with a triangulation suture. Arrow A indicates superficial fascial system; arrow B, SBS implant; arrow C, skin edge.

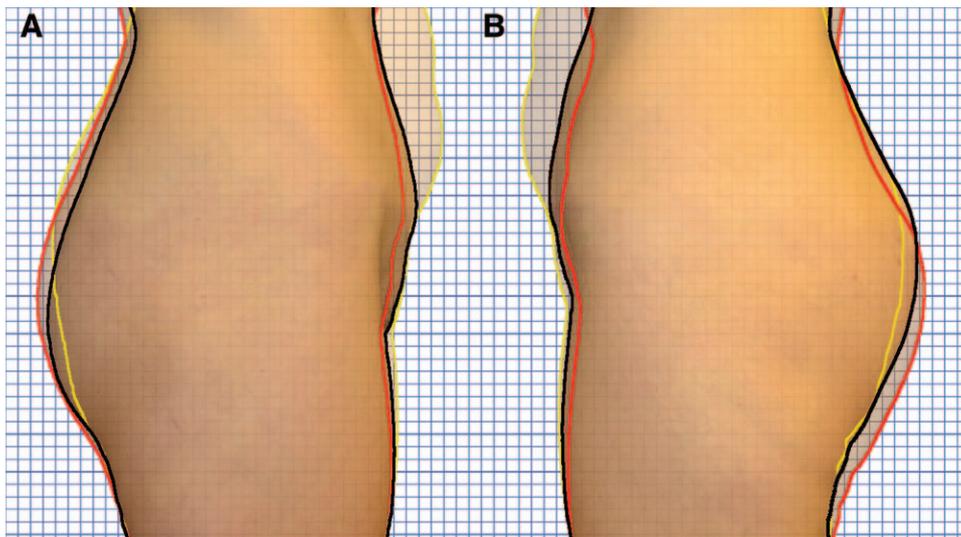


Fig. 4. Silhouette diagram of the patient's right (A) and left (B; SBS side) profiles. The diagram was generated from superimposed clinical photographs with fixed alignment points. Yellow line = preoperative view; red line = 1 month postoperatively; black line = 7 months postoperatively. The SERI side demonstrates greater retention of buttock contour and elevation.

long-lasting support. Moreover, SFS suspension optimizes contours in static and dynamic activities.⁴

Patients who have undergone massive weight loss are a challenging population with unique and varied needs. Male gender, nutritional deficiencies, and certain medical conditions (eg, hypothyroidism and Ehlers-Danlos syndrome) may be additional risk factors for wound complications after body contouring surgery.⁶ These issues related to massive weight loss must be considered in addition to factors such as aging, lifestyle, and the physiological stress that accompanies surgery, all of which may adversely affect the perceived surgical outcome and patient satisfaction.

Premenopausal women reportedly deposit more collagen than men during wound healing,² and collagen deposition in men appears to decline with

age.³ This reduction in collagen deposition is independent of cigarette smoking, although both male and female smokers deposit less collagen than non-smokers.² Interestingly, exogenous female hormone replacement, in both men and women, speeds the rate of wound closure and collagen deposition in biopsied wounds. The proposed mechanism is a return of transforming growth factor- β_1 to optimal levels.² Furthermore, elastin degeneration is critical to the aging of connective tissue.⁹ This process is most noticeable in the middle of the fifth decade of life. Although injury to elastin fibers is often ascribed to a mechanical mechanism alone, hormonal factors appear strongly associated with the degree of elastin degeneration. Finally, adiposity has a strong influence on elastin; enlarged subdermal fat cells

Kornstein • SERI Surgical Scaffold

along with calcium and lipids accelerate the weakening of deep fibrous spans of the SFS.⁴ Therefore, the SBS may be especially advantageous in cases such as these. Additional studies are needed to determine the exact histologic and biochemical effects of this scaffold on the skin and subcutaneous tissues.

Although some surgeons believe that inadequate correction of the saddlebag deformity results from failure to remove enough skin, and consequently have modified their technique to fully abduct the thigh and increase tension during closure,⁸ the present case demonstrates that this extreme approach can be avoided with proper support and stabilization of the SFS and surrounding tissue. Unnecessary abduction of tissue may impair contour, and increased tension can result in tearing and delayed healing. However, such problems can potentially be avoided by implantation of the SBS.

Diseased skin collagen/elastin and the inability to transmit mechanical forces during surgery are major contributors to postoperative skin laxity,^{8,9} both of which may be addressed by the SBS. This strong biocompatible bioprotein provides immediate physical and mechanical stabilization of soft tissue.¹⁰

CONCLUSIONS

This case study demonstrates that SBS is a promising adjunct for body lift surgery when applied with precision by experienced plastic surgeons. The scaffold provides renewed support for qualitatively damaged soft tissue via reinforcement at the zone of SFS reconstruction. This may reduce postoperative skin sagging, expedite healing, and improve postoperative outcomes including patient satisfaction. Further clinical research may reveal an indication for the SBS in routine surgical procedures in postmenopausal woman not receiving hormone replacement therapy and in other populations such as men, cigarette smokers, and patients over 45 years old.

Andrew Kornstein, MD, FACS
Museum Mile Surgery Center
1050 Fifth Avenue
New York, NY 10028
E-mail: andrewkornstein@gmail.com

ACKNOWLEDGMENT

Writing and editorial assistance was provided to the author by Lynda Seminara of ClearView Medical Communications, Cherry Hill, N.J.

PATIENT CONSENT

The patient provided written consent for the use of her image.

REFERENCES

1. Khosla S, Melton LJ III, Atkinson EJ, et al. Relationship of serum sex steroid levels and bone turnover markers with bone mineral density in men and women: a key role for bioavailable estrogen. *J Clin Endocrinol Metab.* 1998;83:2266–2274.
2. Jorgensen LN, Sorensen LT, Kallehave F, et al. Premenopausal women deposit more collagen than men during healing of an experimental wound. *Surgery* 2002;131:338–343.
3. Lenhardt R, Hopf HW, Marker E, et al. Perioperative collagen deposition in elderly and young men and women. *Arch Surg.* 2000;135:71–74.
4. Lockwood TE. Superficial fascial system (SFS) of the trunk and extremities: a new concept. *Plast Reconstr Surg.* 1991;87:1009–1018.
5. Lockwood TE. Lower-body lift. *Aesthet Surg J.* 2001;21:355–370.
6. Shermak MA, Chang D, Magnuson TH, et al. An outcomes analysis of patients undergoing body contouring surgery after massive weight loss. *Plast Reconstr Surg.* 2006;118:1026–1031.
7. Shermak MA. Body contouring. *Plast Reconstr Surg.* 2012;129:963e–978e.
8. Hurwitz DJ, Rubin JP, Risin M, et al. Correcting the saddlebag deformity in the massive weight loss patient. *Plast Reconstr Surg.* 2004;114:1313–1325.
9. Elbaz J-S, Flageul G. Mechanical properties and aging of the abdominal wall. In: Elbaz J-S, Flageul G, eds. *Plastic Surgery of the Abdomen.* New York, N.Y.: Masson; 1979: 29–39. [Translated by Keavy WT from the original French edition *Chirurgie Plastique de L'Abdomen.* Paris, France: Masson; 1977.]
10. Allergan. SERI® Surgical Scaffold Product Information. IFU-SCFLD-001 Rev K. Irvine, Calif.: Allergan; 2013.
11. Jewell M, Lehfeltdt M, Downey S, et al. Clinical experience with the SERI™, a silk-derived bioresorbable scaffold, in two-stage implant-based breast reconstruction. Poster presented at: 17th World Congress of the International Confederation for Plastic, Reconstructive, and Aesthetic Surgery (IPRAS). February 24–March 1, Santiago, Chile.
12. Bengston B, Baxter RA, Clemens MW, et al. A 12-month survey of early use and surgeon satisfaction with a new highly purified silk matrix: SERI Surgical Scaffold. *Plast Reconstr Surg Glob Open* 2014;2:e182.
13. Gross JE. Use of SERI Surgical Scaffold for soft-tissue support in a massive weight loss patient. *Plast Reconstr Surg Glob Open* 2013;1:e86.
14. Kornstein A. SERI® Surgical Scaffold as an adjunct to conventional brachioplasty: a case report. *Plast Reconstr Surg Glob Open* 2014;2:e190.
15. Pascal JF, Le Louarn C. Remodeling bodylift with high lateral tension. *Aesthetic Plast Surg.* 2002;26:223–230.
16. Le Louarn C, Pascal JF. Autologous gluteal augmentation after massive weight loss. *Plast Reconstr Surg.* 2008;121:1515–1516; author reply 1516–1517.