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Placement of Absorbable Dermal Staples in Mammaplasty and Abdominoplasty: A 12-Month Prospective Study of 60 Patients

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Abstract

Background: The duration to close an incision is an important consideration in plastic surgery. The placement of Insorb absorbable subcuticular staples (Insorb, Incisive Surgical, Plymouth, MN) may allow for a decreased closure time compared with other modalities.

Objectives: The authors evaluated the utility of Insorb staples for the closure of mammaplasty and abdominoplasty incisions.

Methods: Sixty patients who underwent anterior abdominal dermatolipectomy, total circular abdominal dermatolipectomy, bilateral breast reduction, or bilateral mastopexy were evaluated in a prospective study. Dermal closure was achieved on 1 side of each patient with Insorb absorbable staples and on the other with absorbable monofilament sutures. Scar quality, pruritus, and pain were scored according to a modified Vancouver Scar Scale (mVSS) at 1, 6, and 12 months postoperatively.

Results: Closure with absorbable staples was approximately 7-fold faster than closure with absorbable sutures for all surgical procedures. No significant differences in mVSS scores were noted between incisions closed with staples vs sutures.

Conclusions: Absorbable staples enable faster closure of a surgical incision without compromising scar quality or patient comfort.

Level of Evidence: 3

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In plastic and aesthetic surgery, it is essential that the scar left by a procedure is inconspicuous. Scar quality depends on characteristics of the patient, the type of operation, and the materials involved and can be optimized by the closure technique. During closure, care must be taken to evert cutaneous edges and avoid tension. With long incisions and multiple dermal stitches, the closure time can be protracted.

More rapid closure decreases the overall operating time, the amount of anesthetic, and the risk of infection.[1,2] For surgical procedures involving extensive suturing, inflammation and infection can result from aggressive tissue manipulation and the presence of foreign bodies.[3] Compared with monofilament sutures, braided sutures require fewer ties to maintain knot integrity but increase the risk of contamination owing to bacterial adherence.[4] Closure devices that can be placed quickly without compromising the aesthetic result or increasing the risk of inflammation are of major interest to plastic surgeons.

Insorb is a system of absorbable skin staples (Insorb, Incisive Surgical, Plymouth, MN) that has received approval from the Food and Drug Administration (FDA, United States) and the Agence Française de Sécurité Sanitaire des Produits de Santé (AFSSAPS, France). The Insorb system is supplied as a single-use Class III device that is sterilized with gamma rays. The stapler comprises an ergonomic handle with a lever to activate staple placement, 2 lateral compression arms, and a nonrechargeable stapling module containing 30 staples (Figure 1). The compression arms grasp and hold each edge of the incision in the path of 2

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Figure 1. The Insorb system is supplied as a stapler containing 30 absorbable staples.

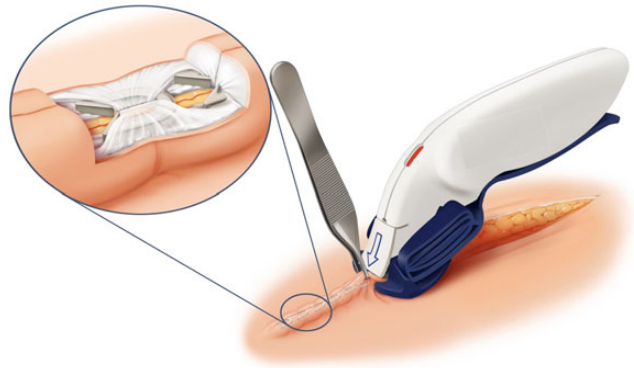

Figure 2. The Insorb stapler allows for cutaneous eversion and deep dermal insertion of absorbable staples. The stapler is positioned 30° from the skin for optimal efficacy of closure.

surgical needles, initially contained within the device. Deployment of the stapler projects the needles forward to surgically bite and appose the incision edges and secures closure of the incision by staple placement (Figure 2).

Tissue approximation during closure with the Insorb device is facilitated with a proprietary stainless steel double Adson forceps (Figure 3). The forceps is resterilizable and comprises 2 arms that close on a central axis. Different tensions can be placed on each arm enabling the surgeon to grasp either or both tissue edges with 1 hand. This is especially important for correcting the incongruous lateral edges of the skin for abdominoplasty and horizontal mammaplasty incisions (Figure 4).

Staples delivered by means of the Insorb stapler are rigid, colorless, smooth, and radiotransparent (Figure 5). The staples are u-shaped (5 mm long, 3.5 mm wide, 0.7 mm thick) with cleats at the ends to enable anchorage in the dermis with tissue eversion. Insorb staples are prepared from an absorbable copolymer of polylactic acid (70%) and glycolic acid (30%) and are similar in composition to Monocryl (poliglecaprone 25) 3-0 absorbable monofilament sutures (Ethicon, Somerville, NJ). The polymers are metabolized by hydrolysis rather than polynuclear phagocytosis and therefore involve minimal inflammation.

Absorption of monofilament sutures is associated with minimal inflammation[5] and occurs over a duration similar to that of Insorb staples.[6] The first hallmark of Insorb staple absorption is loss of resistance to tension.[7] Herridge[8] found that residual resistance was 60% on day 7 postoperatively, 40% on day 14, and 15% on day 21 without a substantial decrease in mass of the staple during the first 2 months. At 10 to 12 weeks postoperatively, the observed mass of the staple was approximately half of its initial mass, and absorption was complete at 4 months.[8] Because heat accelerates absorption of the Insorb staple, the device is supplied with a thermosensitive pellet on the packaging to verify that it was not subjected to excessive heat before surgical placement.

The aim of the present study was to evaluate the closure time, aesthetic quality, and postoperative pain associated with placement of Insorb absorbable staples in plastic surgical procedures.

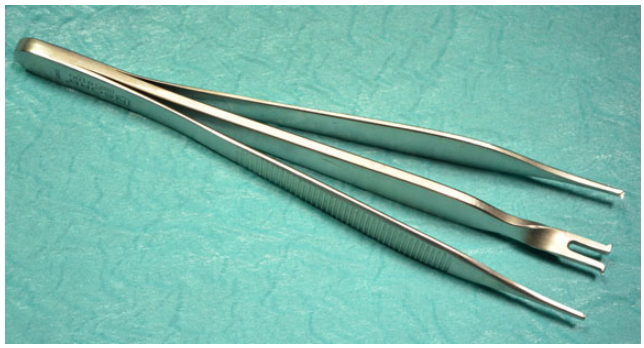

Figure 3. The proprietary double Adson forceps enables manipulation of each tissue edge during closure of an incision.

METHODS

Patients and Study Design

Sixty consecutive patients who presented for aesthetic surgical procedures and underwent incision closure with Insorb absorbable staples from April 2011 to July 2012 were evaluated in a prospective study. The same surgeon performed all of the operations at 2 separate private clinics. Patients presenting for anterior abdominal dermatolipectomy with umbilical repositioning (22 patients), total abdominal circular dermatolipectomy (5 patients), or bilateral breast reduction or mastopexy (33 patients) were included in the study. These surgical procedures were included because of the incision lengths and typical closing durations involved. Patients who underwent mammaplasty received horizontal, vertical, and periareolar incisions. Patients presenting with a pathology or treatment that could interfere with cutaneous healing (eg, long-term corticotherapy, active infection, or immunosuppression owing to infection with human immunodeficiency virus or hepatitis C or long-term pharmacologic

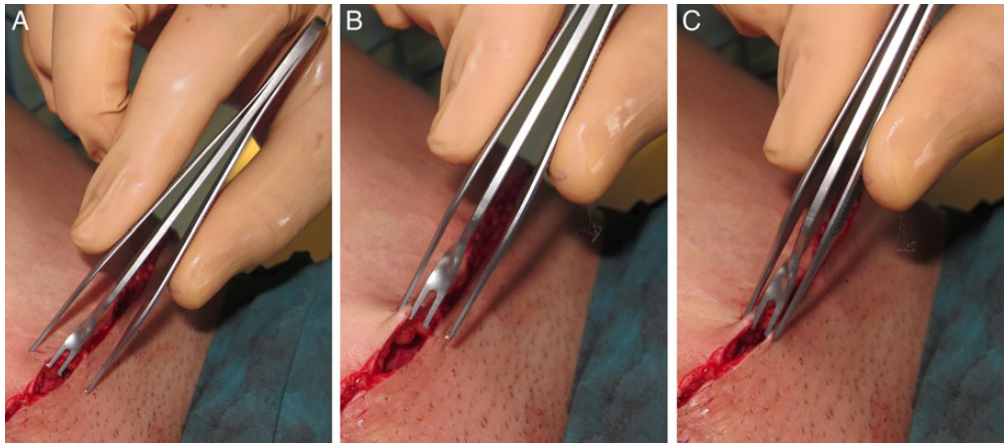

Figure 4. (A) Intraoperative utilization of the double Adson forceps in this 41-year-old woman who underwent abdominal dermatolipectomy. (B, C) The forceps allows the surgeon to grasp each side of the incision individually.

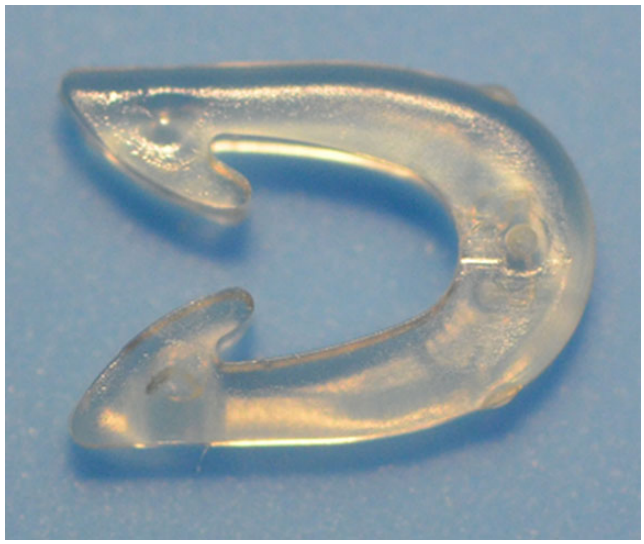

Figure 5. Close-up view of an Insorb absorbable staple.

immunosuppression) were excluded from the study. The trial was offered to 74 patients, 14 declined to participate, and 60 were enrolled in the study.

All patients received information about the study and provided written informed consent. Preoperatively, all patients received a standard biological assessment of blood type, blood count, and hemostasis. The study was conducted in accordance with the guidelines of the Declaration of Helsinki.

Surgical Technique and Intraoperative Assessments

All patients underwent general anesthesia and orotracheal intubation for plastic surgical procedures. Each patient underwent a bilateral procedure with closure by Insorb staples on 1 side (treatment) and Monocryl 3-0 absorbable monofilament sutures on the other side (control). The treated side was randomly chosen to avoid bias in the evaluation of scar quality, pruritus, or pain. Randomization of treated vs control sides was achieved by placing staples on the right side of the patient and sutures on the left on even days of the month and the converse on odd days of the month.

Abdominal dermatolipectomy was performed with the patient in a supine position with the lower limbs raised. Patients who underwent total circular abdominal dermatolipectomy were in a prone position first and then were moved to a supine position with the lower limbs raised. Mammaplasty was performed with the patient in a half-sitting position.

At time of incision closure on the treated side, the cutaneous edges of the incision were lifted to 3 mm and the edges were approximated with a double Adson forceps held in 1 hand (Figure 4). With the other hand, the stapler was positioned against the central axis of the forceps in the subcuticular dermis to ensure staple placement entirely beneath the skin (Figure 2). The stapler was held parallel with the skin to deploy staples horizontally into the subcuticular tissue while avoiding superficial positioning, which could yield an exposed staple. With the device raised, the stapler lever was advanced with the lateral compression arms grasping both edges of the incision. The surgical needles then were advanced into the capture zones on either side of the incision. Horizontal placement of the staple in the subcuticular tissue (Figure 6) was indicated by an audible click. This procedure enabled slight eversion of the tissue edges (Figure 7).

The staples were placed at a minimum interval of 7 mm. The manufacturer recommends stopping incision closure 2 cm from the end of the incision and reversing the direction of the stapler to place the last staples. In the present study,

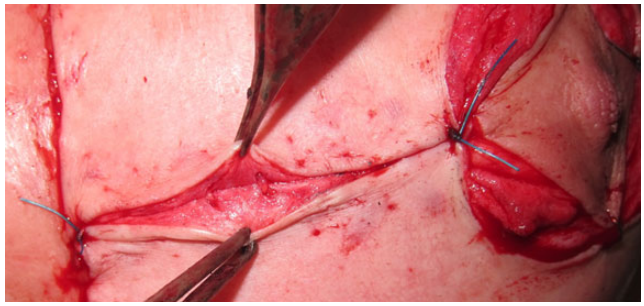

Figure 6. Insorb staples must be placed in the deep dermis to avoid staple exposure as shown in this 32-year-old woman who underwent mammaplasty.

Figure 7. Perioperative view of this 32-year-old who underwent mammaplasty. The tissue edges remain slightly everted after stapling. This image was taken 15 minutes after stapling. Closure of the incision was completed with Monocryl 3-0 monofilament sutures on each side.

stapling began at the lateral ends of the incisions to preclude unevenness in the ends and avoid a lateral dog ear. After insertion of each staple, upward traction was applied to the cutaneous edges with the stapler closed to more rapidly position the double Adson forceps. If a staple was poorly positioned, it was cut in half with a scissors and withdrawn by pulling on the hooks of the staple with forceps.

For all patients, surgical closure was performed in 2 layers: a deep dermal layer was closed with absorbable staples on the treated side or inverted absorbable sutures on the control side, and the superficial dermal layer was closed with intradermal running sutures on both sides. Several interrupted high-tension sutures were placed between the superficial fascia and the aponeurosis of the muscle of the anterior abdominal wall in the umbilical area and between the umbilicus and the pubis. Specifically, for patients who underwent mammaplasty, absorbable staples were placed on 1 breast, including the areola, which received 4 staples. Incision closure on the other breast was achieved with Monocryl 3-0 sutures with the areola receiving 4 stitches. Closure then was completed on both breasts with Monocryl 3-0 subcuticular sutures. Dermal closure for patients who underwent abdominal dermatolipectomy proceeded medially from the lateral edges with Insorb staples on 1 side and Monocryl 3-0 sutures on the other side. A Monocryl 2-0 suture was placed on both sides for patients who underwent mammaplasty with inverted T closure or abdominal dermatolipectomy with a medial stitch because tension on the edges was considerable for these cases. For total circular abdominal dermatolipectomy, a Monocryl 2-0 suture was placed to close the lateral stitches, the stitch above the buttock crease, and high-tension zones that could heal poorly otherwise. Incision closures were then completed on both sides with Monocryl 3-0 subcuticular sutures.

Intraoperatively, the incision lengths, the number of staples or sutures placed, and the duration of the dermal closure were noted. For patients who underwent mammaplasty, the lengths of the vertical and horizontal branches and periareolar incisions were recorded. The closure duration was regarded as the time required to place all of the staples or deep dermal sutures. The duration of subcuticular suture placement for the second layer of closure was not measured.

A video demonstrating the surgical technique on a 33-year-old woman undergoing abdominoplasty with umbilical transposition is available at www.aestheticsurgeryjournal.com.

Postoperative Care and Evaluation of Outcomes

Postoperatively, the patients received daily dressing of the surgical site by a nurse for 2 weeks and follow-up by the surgeon at 1, 2, and 4 weeks and at 3, 6, and 12 months. Anticoagulants (low-molecular-weight heparin) were administered for 2 weeks after abdominal dermatolipectomy. All patients received analgesics for several days postoperatively when necessary.

Patients assessed postoperative results nonanonymously according to a modified Vancouver Scar Scale (mVSS) at 1, 6, and 12 months. This scoring system addressed vascularization, pigmentation, pliability, height of the scar, pruritus, and postoperative pain on a scale from 1 to 17 (Table 1). Throughout the study, the patient was not informed regarding which side was closed with staples. Postoperative evaluation of scar quality was conducted by the operating surgeon without distinguishing the treated vs control side.

Statistical Analysis

Statistical analysis was performed using SPSS software, version 19 (IBM Corporation, Armonk, NY). The mean value was calculated and reported with the standard deviation. A P value $< .05$ was considered statistically significant.

RESULTS

Fifty-eight women and 2 men were included in this study. The mean age of the patients was 41 years (range, 23-61

Table 1. The Modified Vancouver Scar Scale (mVSS)

Category	Parameter	Descriptor	Score
Scar characteristics	Vascularity	Normal	0
		Pink	1
		Red	2
		Purple	3
	Pigmentation	Normal	0
		Hypopigmentation	1
		Hyperpigmentation	2
	Pliability	Normal	0
		Supple	1
		Yielding	2
		Firm	3
		Banding, rope-like	4
		Contracture	5
	Height	Flat	0
		<2 mm	1
		2-5 mm	2
		>5 mm	3
Pain	Extent	None	0
		Occasional	1
		Requiring treatment	2
Pruritis	Extent	None	0
		Occasional	1
		Requiring treatment	2
Total score			17

Table 2. Perioperative Results of Mammaplasty

	Mammaplasty (Per Breast)	
Subcutaneous closure device	Staples[a]	Sutures[b]
Mean no. of device applied to close incision (SD)	21.52 (2.20)	28.60 (4.30)
Mean closure time (SD), min[c], → $P < .01$.	2.50 (0.20)	16.90 (3.90)
Mean length of scar (SD), cm	48.00 (4.34)	47.10 (4.34)
Mean inverse closure speed (SD), min/cm → Mean time to insert 1 staple (SD), sec	0.05 (0.08) 6.78 (0.54)	0.35 (0.21)
Mean frequency of device placement (SD), cm^{-1}	0.45 (0.12)	0.60 (0.19)
Mean closure speed (SD), cm/min[c], → $P < .01$.	19.20 (0.04)	2.78 (0.04)

SD, standard deviation. [a]Insorb absorbable staples. [b]Monocryl 3-0 absorbable monofilament sutures. [c]$P < .01$.

Table 3. Perioperative Results of Abdominoplasty

	Abdominoplasty (Per Side)	
Subcutaneous closure device	Staples[a]	Sutures[b]
Mean no. of device applied to close incision (SD)	22.02 (2.70)	30.20 (3.20)
Mean closure time (SD), min[c], → $P < .01$	1.30 (0.41)	10.10 (0.59)
Mean length of scar (SD), cm	23.90 (2.57)	24.50 (2.57)
Mean inverse closure speed (SD), min/cm → Mean time to insert 1 staple (SD), sec	0.06 (0.02) 3.72 (0.27)	0.41 (0.04)
Mean frequency of device placement (SD), cm^{-1}	0.92 (0.14)	1.23 (0.12)
Mean closure speed (SD), cm/min[c], → $P < .01$	18.38 (0.04)	2.43 (0.02)

SD, standard deviation. [a]Insorb absorbable staples. [b]Monocryl 3-0 absorbable monofilament sutures. [c]$P < .01$.

years). All 60 patients (100%) received follow-up for 1 year. The mean numbers of staples or sutures placed, closure durations, scar lengths, spacing of staples or sutures, and closure speeds were compared between the stapled sides and the sutured sides for patients who underwent mammaplasty (Table 2) or abdominoplasty (Table 3).

Closure Duration and Speed

The differences in the mean times for closure between the treated sides and the control sides were statistically significant according to the Wilcoxon signed-rank test ($P < .01$) for patients who underwent mammaplasty (Table 2) or abdominoplasty (Table 3). Specifically, the mean closure times for patients who underwent mammaplasty were 2.50 ± 0.20 minutes with staples and 16.90 ± 3.90 minutes with sutures ($P < .01$). The mean closure speeds (± standard deviation [SD]) for mammaplasty were 19.20 ± 0.04 cm/min with staples and 2.78 ± 0.04 cm/min with sutures ($P < .01$).

For patients who underwent abdominoplasty, the mean closure times were 1.30 ± 0.41 minutes with staples and 10.10 ± 0.59 minutes with sutures ($P < .01$). The mean closure speeds for abdominoplasty were 18.38 ± 0.04 cm/min

with staples and 2.43 ± 0.02 cm/min with sutures ($P < .01$). In general, the closure speeds with staples were 7-fold faster than with sutures for mammaplasty and 7.5-fold faster than with sutures for abdominoplasty. In our study, the mean time to insert 1 staple was 6.78 seconds for mammaplasty and 3.72 seconds for abdominoplasty. The spacing between each closure device (calculated by extrapolation) differed with 0.45 staples/cm placed vs 0.60 sutures/cm placed for mammaplasty.

Scar Quality

There were no significant differences between the treated and control sides regarding most measures of scar quality at 1, 6, and 12 months postoperatively (Figures 8 and 9; Tables 4-6). At 1 month postoperatively, the scar height corresponding to the stapled incision was significantly higher than that of the sutured incision ($P < .05$; Table 4). However, this difference did not persist beyond the early postoperative period.

Postoperative Pain

Pain was evaluated according to an mVSS at 1, 6, and 12 months postoperatively (Tables 4-6). There was no significant difference between the two groups regarding the evaluation of pain and pruritus.

Complications

Three of 60 patients (5.0%) had exposed staples, including 1 patient who underwent mammaplasty and 2 patients who underwent abdominoplasty. However, there were no cases of delayed healing. Four patients (6.7%) who underwent abdominal dermatolipectomy experienced lymphorrhea that required subcutaneous draining.

DISCUSSION

There are several descriptions of the Insorb system in the literature. Experimental studies of Insorb staple placement in pig models[7] and clinical studies commissioned by the manufacturer[9] have been published. In addition, a controlled, randomized, prospective clinical study;[10] a nonrandomized, prospective multicenter study;[11] and a 2-year, preliminary clinical study[12] have been performed. The results of these studies indicated faster closure times with reduced operating and anesthesia times and comparable aesthetic results with Insorb staples vs sutures. However, a comparison of scar quality following closure with these devices is lacking.

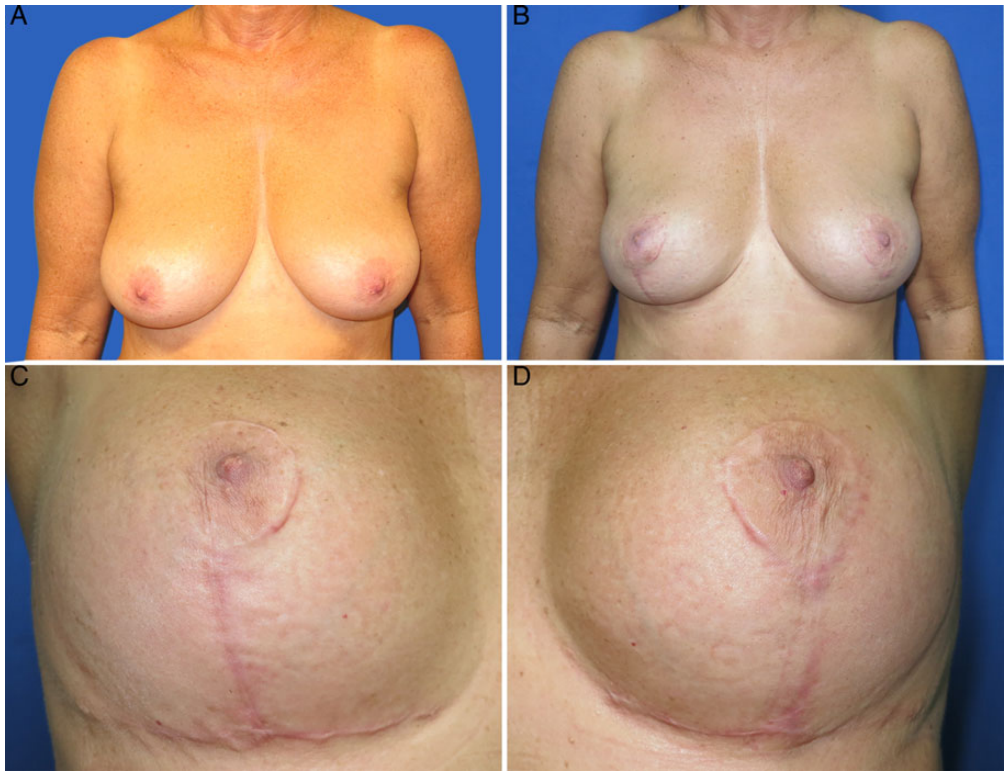

Figure 8. (A) Preoperative view of this 53-year-old woman. (B) One year after the patient underwent mammaplasty with (C) suture closure in the right breast and (D) staple closure in the left breast.

Figure 9. (A) Preoperative view of this 42-year-old woman. (B) One year after the patient underwent abdominoplasty with umbilical transposition. The incision was closed with (C) sutures on the right and (D) staples on the left.

Table 4. Results of the Modified Vancouver Scar Scale at 1 Month Postoperatively

Parameter (Score Range)	Staples,[a] Mean ± SD	Sutures,[b] Mean ± SD
Scar vascularization (0-3)	0.62 ± 0.68	0.41 ± 0.47
Scar pigmentation (0-2)	0.59 ± 0.90	0.69 ± 0.79
Scar pliability (0-5)	1.69 ± 0.96	1.52 ± 1.12
Scar height (0-3)[c] $P < .05$	1.11 ± 0.87	0.27 ± 0.41
Pain (0-2)	0.22 ± 0.10	0.28 ± 0.13
Pruritis (0-2)	0.15 ± 0.08	0.19 ± 0.14
Overall (0-17)	4.38 ± 3.45	3.36 ± 3.51

SD, standard deviation. [a]Insorb absorbable staples. [b]Monocryl 3-0 absorbable monofilament sutures. [c]$P < .05$.

Table 5. Results of the Modified Vancouver Scar Scale at 6 Months Postoperatively

Parameter (Score Range)	Staples,[a] Mean ± SD	Sutures,[b] Mean ± SD
Scar vascularization (0-3)	0.69 ± 0.54	0.57 ± 0.29
Scar pigmentation (0-2)	0.78 ± 0.84	0.79 ± 0.73
Scar pliability (0-5)	0.74 ± 0.65	0.76 ± 1.93
Scar height (0-3)	0.30 ± 0.77	0.25 ± 0.51
Pain (0-2)	0.07 ± 0.16	0.06 ± 0.12
Pruritis (0-2)	0.02 ± 0.11	0.01 ± 0.19
Overall (0-17)	2.60 ± 2.32	2.44 ± 2.69

SD, standard deviation. [a]Insorb absorbable staples. [b]Monocryl 3-0 absorbable monofilament sutures.

In the present study, each patient was his or her own control, and patients were monitored for 12 months. All of the patients were operated by the same surgeon to reduce or eliminate performance bias. Evaluations of scar quality included the periareolar scar and scars left from total circular abdominal dermatolipectomy. In 2 studies of animal models, Insorb staples were compared with a braided suture, Vicryl (Ethicon) sutures.[7,9] To our knowledge, the present study is the first to compare Insorb staples with Monocryl 3-0 sutures, which elicit less inflammation than absorbable braided sutures.[5]

Complications

In the present study group of 60 patients, there were no cases of inflammation, local infection, or disunion. The 3 patients who developed exposed staples were among the

Table 6. Results of the Modified Vancouver Scar Scale at 12 Months Postoperatively

Parameter (Score Range)	Staples,[a] Mean ± SD	Sutures,[b] Mean ± SD
Scar vascularization (0-3)	0.23 ± 0.38	0.26 ± 0.47
Scar pigmentation (0-2)	0.43 ± 0.90	0.39 ± 1.40
Scar pliability (0-5)	0.24 ± 0.84	0.28 ± 0.76
Scar height (0-3)	0.12 ± 0.53	0.14 ± 0.17
Pain (0-2)	0	0
Pruritis (0-2)	0	0
Overall (0-17)	1.04 ± 0.25	1.08 ± 0.61

SD, standard deviation. [a]Insorb absorbable staples. [b]Monocryl 3-0 absorbable monofilament sutures.

first to undergo aesthetic surgery in this study. These complications likely resulted from superficial positioning of the stapler and incorrect angulation of the stapler with the tissue surface. The staples are transparent on insertion but become white during absorption. Exposed staples are easy to locate and simple to withdraw. During the course of this study, we found that 30° angulation of the stapler, sufficiently deep dermal positioning of the staples, and sufficient traction with the forceps were crucial maneuvers to avoid staple extrusion. Our rate of staple extrusion decreased during this study as we developed our surgical technique.

Pharmacoeconomic Cost

The Insorb stapler is supplied with 30 staples. In our study, 1 stapler was consumed per unilateral mammaplasty (mean, 22 staples; treatment side) vs 2 Monocryl 3-0 sutures per unilateral mammaplasty (control side). We consumed 1 stapler per anterior abdominal dermatolipectomy and 2 staplers per circular abdominal dermatolipectomy (or 1 stapler per side). Our results were similar to those of Cross et al[10] who consumed 16 staples vs 2 sutures for the same incision length. In France, the Insorb system is supplied as a set of 6 staplers costing €55 per stapler (not including sales tax). A mammaplasty or abdominal dermatolipectomy requires 2 staplers and a total circular abdominal dermatolipectomy requires 4 staplers. Hence, the added cost associated with this stapler vs sutures is substantial.

The cost of 1 stapler (for 1 side) can be compared to the cost (not including sales tax) of 2 Monocryl 3-0 sutures (€4.92 × 2 = €9.84), 2 Vicryl 3-0 sutures (€7.11 × 2 = €14.22), or 2 Polysorb (€4.70 × 2 = €9.40) sutures (Polysorb, Covidien, Medline Industries, Mundelein, IL). In a pharmacoeconomic study, Cross et al[10] reported that operating room costs could be reduced by replacing sutures with staples. This savings must be weighed against the cost of the stapler and the number of operations at surgical centers in which stapling incisions would be appropriate.[13] The shorter operating times associated with staple closure could allow a surgical center to accommodate more daily surgical procedures and potentially could increase operating room profitability.

With Insorb staples, our results indicate a cost of €3.82/min (€110/28.8 min) for mammaplasty and €6.79/min for abdominoplasty (€110/16.2 min) or dermatolipectomy (€220/32.4 min). Given the mean cost of an operating room in Paris, France, of €650/h (€10.80/min), the mean savings would be €312 for mammaplasty, €175 for abdominoplasty, and €351 for total circular abdominal dermatolipectomy.

Closure Speed

Cross et al[10] found a 4-fold faster closure speed with staples vs sutures to close a linear mastectomy incision. Our closure speeds with staples were 7-fold faster than with sutures for mammaplasty and 7.5-fold faster for abdominal dermatolipectomy. For longer and more linear incisions, the time savings were greater. A reduced closure time decreases the risk of morbidity associated with anesthesia; the durations of intubation, patient cooling, and decubitus; and the likelihood of perioperative infection.

The device placement interval was greater for staples than for sutures with 0.45 staples/cm vs 0.60 sutures/cm for mammaplasty and 0.92 staples/cm vs 1.23 sutures/cm for abdominal dermatolipectomy. The number of devices (sutures or staples) per cm was greater for abdominal dermatolipectomy than for mammaplasty because of the skin tension on the edges due to umbilical transposition. Staples cannot be placed any closer to each other owing to a technical limitation of the stapler. The insertion of more staples likely would not produce an additional benefit because the closure procedure involved a superficial intradermal monofilament suture.

In our study, the mean time to insert 1 staple was 6.97 seconds for mammaplasty and 6.36 seconds for abdominoplasty. This difference could be attributed to the linearity of the abdominal incision, which facilitated stapling, and the technical difficulty associated with closing the areola.

Scar Quality and Postoperative Pain

At 1 month postoperatively, scar height was significantly greater for incisions closed with staples than with sutures ($P < .05$). The staples produce everted tissue edges compared with standard sutures, but this difference did not persist at 6 or 12 months postoperatively (Figures 8 and 9). Scores for pigmentation, pliability, vascularization, pruritus, and postoperative pain were similar for incisions closed with staples vs sutures for all follow-up times ($P > .05$). The results of histologic analyses performed by Cross et al[10] indicated that absorbable staples do not trigger an increase in fibroblast proliferation, inflammation, or collagen deposition, which supports our findings. Because the scars left by staple

closure resembled those left by standard sutures, we consider our findings to validate those of previous studies.[10-12]

The Insorb stapler offers additional advantages. Puncture risk and concomitant accidental bleeding are limited by hooks in the staples. The increased closure speed also reduces fatigue for the surgeon. In this study, we did not compare absorbable staples with other technologies that increase closure speed, such as barbed sutures. In a multicenter randomized clinical trial of absorbable barbed sutures vs absorbable smooth sutures for dermal closure in abdominoplasty, mastopexy, and reduction mammaplasty, Rubin et al[14] found that the mean dermal closure time was significantly lower with barbed vs smooth sutures (12.0 vs 19.2 minutes, respectively; $P < .001$). The results of the present study indicate that the time savings for absorbable staples vs smooth sutures is even greater than for barbed vs smooth sutures.

Indications

We analyzed the closure of incisions with nonlinear edges (eg, the periareolar incision), incongruent edges, and different skin thicknesses (eg, the horizontal incision for mammary or abdominal surgery). We observed no significant differences in long-term scar quality for absorbable staples vs sutures. Any concerns regarding the placement of Insorb staples to close challenging incisions can be ameliorated by overcoming the learning curve. There are no device-specific drawbacks preventing the utilization of staples for these types of incisions. Adept handling of the double Adson forceps is vital in cases involving edges with different thicknesses or requiring an adjustment in the approximation (eg, for a horizontal incision). For an optimal approximation, the first 2 staples should be placed after lifting and pulling the superior cutaneous edge with the forceps and grasping the inferior edge.

The only contraindications for treatment with Insorb staples are associated with cutaneous thickness or quality. For example, skin with stretch marks that is too thin for effective binding would benefit from placement of standard sutures instead of staples. We do not advocate the stapler for cruroplasties or brachioplasties because the skin of the inner thighs and arms is generally too thin. The development of a stapler that inserts smaller staples with more precise anchoring of thin skin is warranted to broaden the current indications and avoid staple extrusion. Insorb is expected to begin marketing a stapler with smaller and thinner staples in 2016. This new device for closing incisions in thin skin will require clinical assessments of absorption time, resistance, and potential complications.

CONCLUSIONS

The results of this prospective study of patients who underwent mammaplasty or abdominal dermatolipectomy indicated that dermal closure with Insorb absorbable staples offers a significant reduction in the operating time compared with that of Monocryl 3-0 sutures without compromising long-term aesthetic results.

Supplementary Material

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

Disclosures

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