



New Concepts in Circumareolar Mastopexy: The “Star Interlocking Suture”—A Case Series

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Abstract The circumareolar approach is one of the most popular and versatile in breast surgeries. Nevertheless, this approach usually implies a closure under tension which could lead to areolar distortion, scar widening and hypertrophic scarring. To prevent these complications, different surgical adjustments to this technique have been proposed, such as the Hammond’s “Interlocking Gore-Tex suture.” Here, we propose a modification of the Hammond interlocking suture, the “Star Interlocking Suture.” Between 2019 and 2023, the “Star Interlocking Suture” was used in 19 patients undergoing breast surgery with circumareolar approach. 3–0 Ethibond suture (Ethibond Excel; Ethicon, US LLC) was used for suturing. All 19 patients showed good results in terms of areolar scar appearance and diameter stability during a mean follow-up period of 12 months. No infections, skin fistulas or suture extrusion were observed. All patients were satisfied with the appearance of their areola and the suture material, green colored, was not visible. Only one patient did report palpability of the suture’s knot.

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Keywords Breast surgery · Circumareolar mastopexy · Interlocking suture · Round block

Introduction

The increasing demand for concealed and inconspicuous scars in breast surgery contributed to the popularity of circumareolar procedures, which minimize visible marks on the breast surface by confining them to the circumareolar region [1]. The circumareolar approach may be useful to address different breast conditions: breast ptosis, breast hypertrophy, tuberous breasts, gynecomastia, augmentation mastopexy, breast fat graft and oncoplastic breast surgery [2–4].

Nevertheless, because of the discrepancy between the areolar diameter and the outer edge of the breast skin circumference, the circumareolar approach usually implies closure of the defect under tension. This may lead to unfavorable outcomes with areolar distortion, scar widening, and hypertrophic scarring [5].

Different techniques designed to prevent these complications have been described in the literature. First in 1990 Benelli introduced the “Round Block” technique for circumareolar mastopexy which relied on a permanent circumareolar “purse string” suture running around the perimeter of circumareolar skin, to limit areolar distortion and widening [6]. In 2007 Hammond et al. described the “Interlocking Gore-Tex suture,” which consisted in “locking” the outer purse-string suture with the areolar edge for eight times, recalling a wheel configuration. This “interlocking suture,” considered as a substantial evolution

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of the “round block” technique, was designed to achieve a durable shaping and control of the areolar diameter, minimizing the risk of the aforementioned complications [7, 8].

Thanks to its biomechanical properties, the “interlocking suture” contrasts two opposite forces: the centrifugal circumareolar skin force and the centripetal areolar skin force, thus decreasing by 14–15% the circumareolar breast skin stress when compared to the “round-block” suture. [5]

Bearing these concepts in mind, we propose a modification of Hammond’s “interlocking suture”: the “Star Interlocking Suture.”

Patients and Methods

All patients undergoing breast surgery with circumareolar approach between 2019 and 2021 were included in the present study. Different surgeries were performed with the circumareolar approach: mastopexy, augmentation mastopexy, breast asymmetry correction, tuberous breast correction and contralateral symmetrization after oncological procedures [9–11]. A specific written informed consent was obtained from all the patients included in the study, to use their data and photographs.

Preoperative markings were carefully planned with the patient in upright position. A schematic representation of the five points used for the “Star Interlocking Suture” is shown in Fig. 1. Surgery started defining the new areolar dimension using a circular areolar template (nipple marker) with a diameter of 42 or 45 mm, according to preoperative markings. After the areolar incision, the outer circumareolar skin was incised as planned and the in between skin deepithelialized (Fig. 2). Once breast remodeling was completed, 4 interrupted 4–0 Monocryl (Ethicon, Inc.,

Somerville, NJ) subdermal stitches were placed at cardinal points between the areola and the outer breast skin (Fig. 3). The upside-down Star Interlocking Suture was placed using a 3/0 Ethibond (Ethibond Excel; Ethicon, US LLC). The needle was passed carefully through the deep dermis of the outer defect and then five times, at regular intervals, into the areolar dermis according to an upside-down star configuration (Fig. 4). By doing so, the areolar dermis was tightly connected to the outer defect dermis in five points, which corresponded to the vertices of an equilateral pentagon. The star configuration was turned “upside-down” to ensure more support to the upper portion of the areolar diameter, that is where the lifting forces are more needed. In fact, by rotating “upside-down” the star configuration,

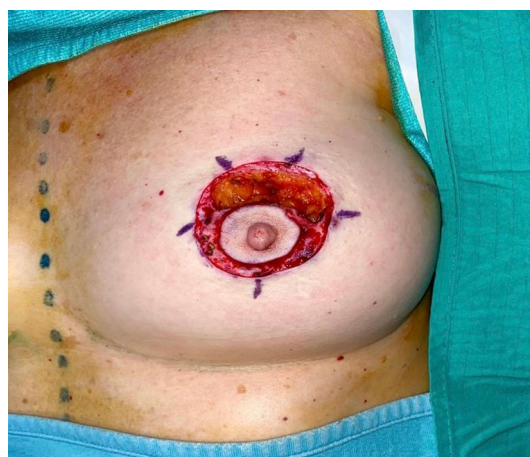


Fig. 2 Periareolar skin was deepithelialized as planned. Marking of the five Star Round Block points

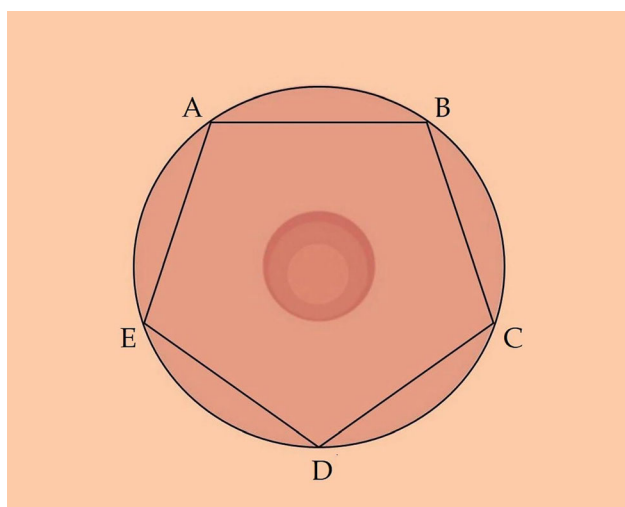


Fig. 1 Schematic representation of the five “Star Interlocking Suture” points



Fig. 3 Four cardinal subcutaneous sutures were placed

there were two interlocking points upward, instead of a single one. Once the suture was passed, a gentle traction was applied on the suture ends until the circumareolar defect opening was reduced to the desired size (Fig. 5).

Great attention was given to bury the suture terminal knot in the subdermal layer with an inverted 4-0 Monocryl stitch to avoid suture exposure or extrusion. Finally, a 4/0 Monocryl intradermal continuous suture was placed. At the end of the surgery, the areolar diameter was measured and recorded for each patient.

Postoperatively, the wound was supported with 3M™ Micropore™ Medical Tape (skin colored) for 6 weeks.

Postoperative photographs were routinely taken at 3, 6 and 12 months after surgery. During the 12 months follow-up appointment, the areolar diameter was measured and compared to the measures taken at the end of the surgery, to assess the stability of the areolar diameter.



Fig. 4 The “Star Interlocking Suture” was placed using a 3/0 (Ethibond Excel; Ethicon, US LLC)



Fig. 5 The “Star Interlocking Suture” ends were pulled to reduce the areolar diameter to the desired size and knotted

A visual analogue scale (VAS) was submitted to patients to evaluate their satisfaction with the appearance of their nipple areola complex after surgery. The result was rated as “not improved,” “improved,” “satisfactory” and “excellent.”

Cosmetic results were also evaluated by 7 different observers (5 plastic surgeons 2 nurses blinded with surgical details) with frontal, lateral, 3/4 left and 3/4 right views of photographs at 1 year follow-up. The appearance of nipple areola complex (NAC), its symmetry, breast shape and breast symmetry were considered. Observers reviewed the pictures and scored the results on a 5-point Likert scale that ranged from “poor result” (1) to “excellent result” (5). A mean score greater than 4 was considered as a satisfactory result.

Results

From January 2019 to December 2021, the “Star Interlocking Suture” was performed in 19 female patients. Patients’ age ranged from 18 to 53 years (mean 35.5) with a mean BMI of 26.4. Mean postoperative follow-up was 15 months. Of the 19 patients, 16 underwent primary surgery, whereas three patients had secondary surgery for breast implant exchange. A total number of 31 breasts were included in this study. In 11 patients, a simple mastopexy was performed, of these, seven had a unilateral mastopexy. Eight patients received bilateral mastopexy with round microtextured implants placed partially submuscular (Dual plane) (Table 1). Breast implants size ranged from 315 to 450 cc, with an average implant volume of 382,5 cc. Mean intraoperative areolar diameter measured intraoperatively was 4.4 cm. Mean diameter measured at 12 months follow-up was 4.57 cm.

T-test showed no significant difference between the mean areolar diameter measured immediately after surgery and the mean areolar diameter measured at the 12 months

Table 1 Patients’ demographic data

Demographics of patients’ population	
Age	18–53 (mean 35,5)
BMI	26,4 (mean)
Surgery related data	
Primary	16
Secondary	3
Types of surgery	
Mastopexy	11 (7 unilateral, 4 bilateral)
Mastopexy + Implants	8
	Tot 19 (31 Breasts)

Table 2 Statistical analysis

	Immediate postop		12-month follow-up		
Mean areolar diameter (\pm SD)	4.40 cm (\pm 0.5)		4.57 (\pm 0.55)		
	Not improved	Improved	Improved	Satisfactory	Excellent
Patient satisfaction (VAS)	/	/	/	10,6% (2)	89,4% (17)
	Breast symmetry		Breast shape	NAC position	Nac shape
Mean clinician's panel evaluation (\pm SD)	4,3 (\pm 0.5)		4 (\pm 1)	4,5 (\pm 0.8)	4,7 (\pm 0.7)

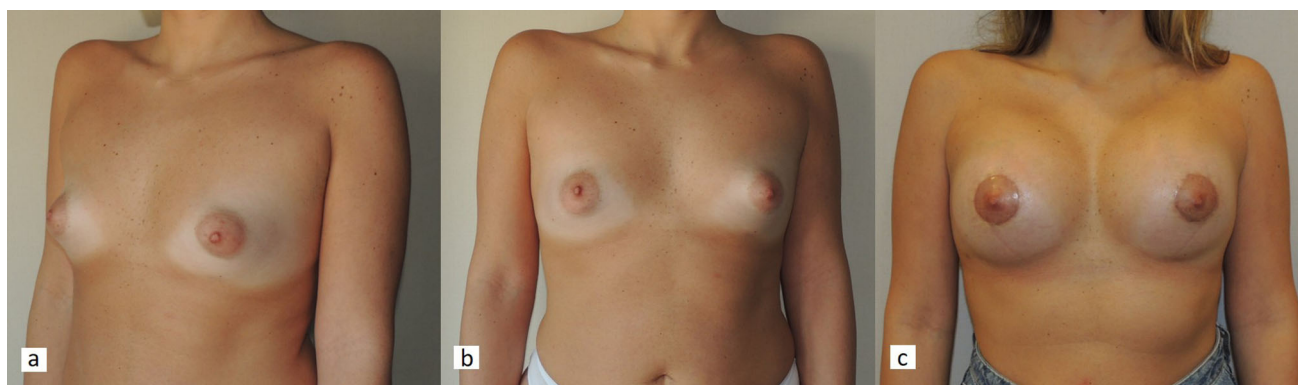
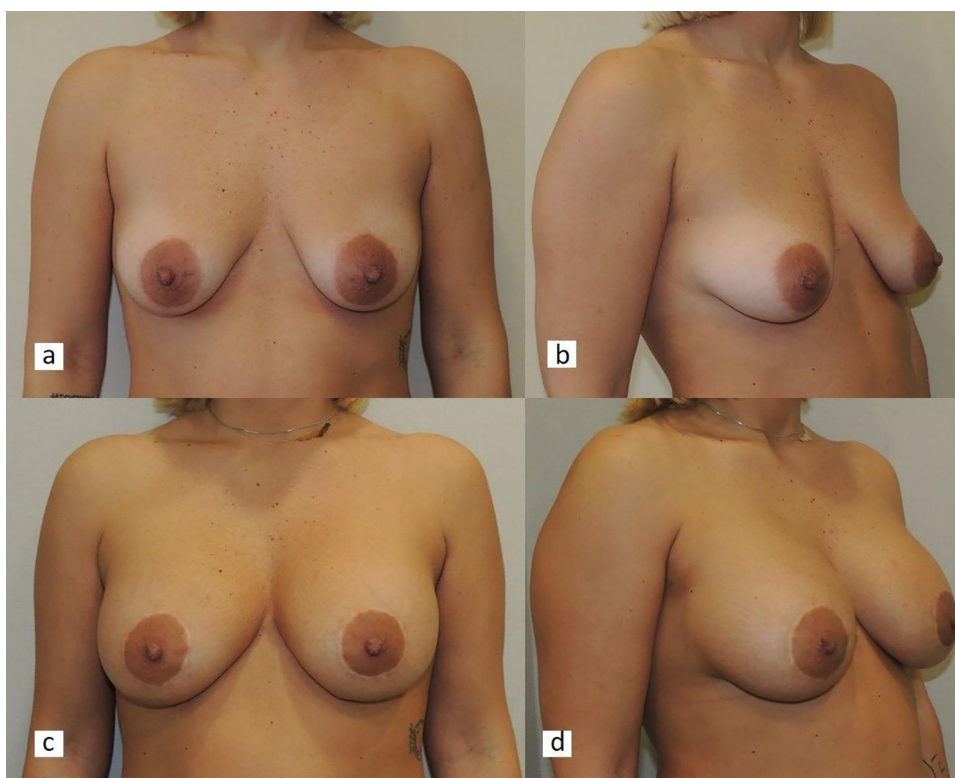
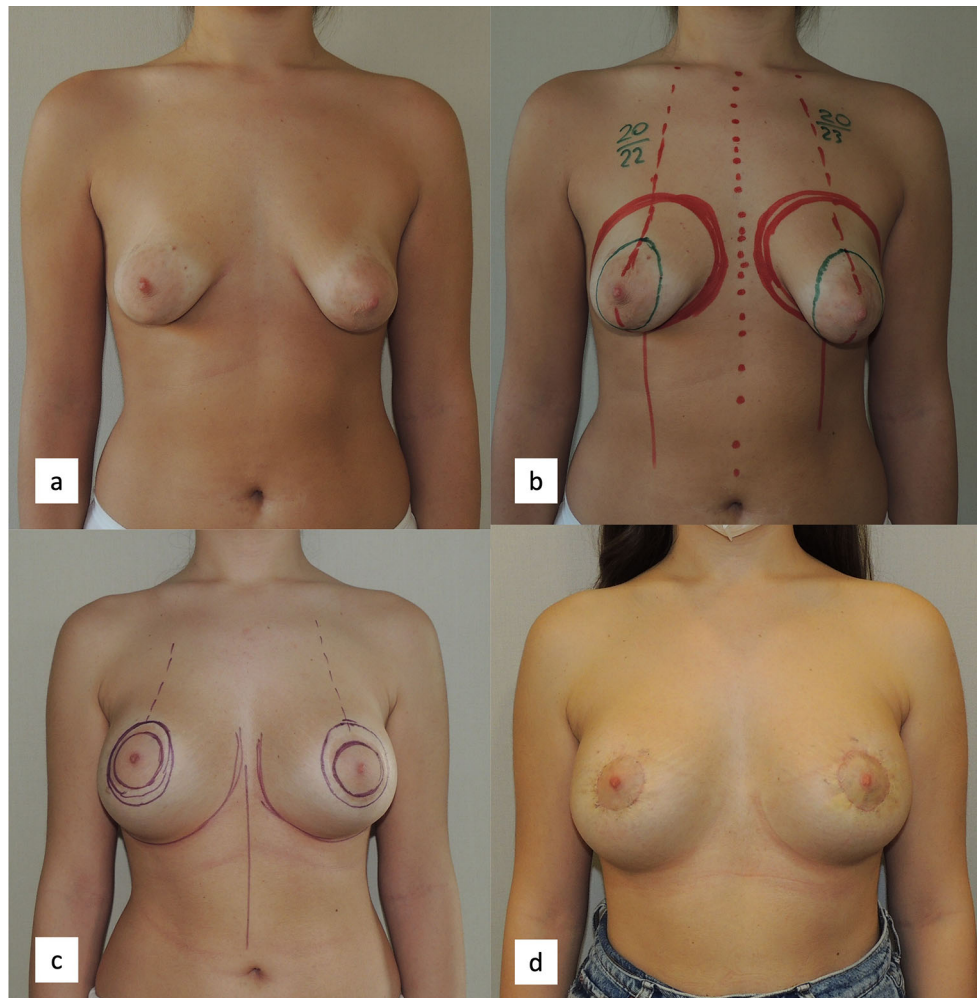
**Fig. 6** **a, b** Patient with bilateral asymmetric tuberous breasts; **c** One-year follow-up: areolar diameter and shape maintained their stability over time**Fig. 7** **a, b** Patient with bilateral asymmetric breast ptosis; **c, d** Fifteen months follow-up: areolar diameter and shape maintained their stability over time

Fig. 8 **a** Patients with bilateral asymmetric tuberous breast, **b**: preoperative markings, **c**: 9 months follow-up showing asymmetry of the NAC with markings for the revision mastopexy, **d**: revision mastopexy postoperative result after 3 months



follow-up (p value: 0.21, t -value: -1). Also, no significant difference was found between patients who had mastopexy with and without implants.

Results were rated as “excellent” by 17 patients (89.4%), while the remaining two patients (10.6%) rated “satisfactory” their result. Mean clinician’s panel evaluation was 4.3 for breast symmetry, 4 for breast shape, 4.5 for NAC position and 4.7 for NAC appearance (Table 2).

The suture material, green colored, was not visible nor palpable for all patients but one. In this patient, the knot was too superficial and thus palpable and visible, so the knot was removed three months postoperatively (Figs. 6, 7, 8).

Discussion

The circumareolar approach has gained popularity in breast surgery in the last decade [1]. Although optimal outcomes can be achieved with this technique, thanks to its versatility and its favorable scar pattern, results can be unsatisfactory

in some cases [12, 13]. Certainly, the tension on the suture line is one of the main factors responsible for poor scar quality, areolar widening and distortion; thus, reducing tension on the suture is mandatory in circumareolar surgery [5]. In the literature, several authors have proposed modification and implementation to the classic circumareolar approach, with the shared goal of ensuring good tension control at the suture edges [14–18].

Different suture materials have been suggested for the “interlocking suture.” Clearly adsorbable materials should not be used, since their support will be lost as soon as they dissolve, causing areolar diameter widening. In its original publication, Hammond suggested the use of the Gore-Tex suture (W.L. Gore & Associates, Flagstaff, AZ, USA), a non-adsorbable, microporous, white, monofilament flexible biomaterial [4, 5]. Salgarello et al. [19] proposed the use of a 3–0 Dafilon with a straight cutting needle (B. Braun Melsungen AG, Melsungen, Germany), a non-adsorbable, undyed, polyamide thread. Nevertheless, these suture materials are fairly rigid, and the knot can be palpable,

which may result in the need to remove the suture or even spontaneous extrusion [20].

The Ethibond (Ethibond Excel; Ethicon, US LLC) is a non-adsorbable, braided, green dyed, surgical suture composed of Polyethylene terephthalate. This material is soft, flexible and wieldy, with a high grip on the tissues and vigorous strength of the knot. It is widely used in hand surgery for tendon repair. Furthermore, it is less expensive and more widespread, compared to the Gore-Tex suture [21–23].

Our “Star Interlocking Suture” is a safe and reliable technique providing a stable areolar size and shape over time. By rigidly locking an internal system (the areola), which tends to contract, to an outer system (circumareolar skin), which tends to move externally, the spreading of the superficial portion of the areola is minimized and the tension can be equally distributed at the suture edges. Thus, the risk of the most common complications in circumareolar surgery is reduced and patient satisfaction is enhanced.

Furthermore, our “Star Interlocking Suture,” by passing just five times through the areolar dermis, instead of the classic “interlocking suture” eight times, is a quick and easy alternative, more suitable for a braided suture such as the Ethibond (Ethibond Excel; Ethicon, US LLC).

Nevertheless, we recognize that this case series presented some limitations. All the procedures in this case series were performed by the first author; and since this technique requires a learning curve, differences might arise depending on the surgeon’s experience, especially for execution times and aesthetic outcomes. Also, we recognize that our series included a limited number of patients, and so it might not be representative of the general population, and the results might not be generalizable. Moreover, other factors, such as patients’ pre-existing health conditions or complications during surgery, may influence the study results, considering a larger population. Further studies with a larger follow-up period, further evaluations in terms of stability and aesthetic outcome or perhaps comparing this technique with other circumareolar suture techniques should be carried out.

In conclusion, our technique can be considered a good compromise between the classic Benelli’s “Round Block” and the Hammond’s “Interlocking Gore-Tex suture,” providing stability to the areolar diameter over time while ensuring at the same time suture impalpability.

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Declarations

Conflict of interest The authors declare that they have no competing financial interests or personal relationships that could have influenced the work reported in this paper.

Ethical Approval For this study our institution Research Ethics Committee confirmed that no ethical approval was required.

Informed Consent Written informed consent has been obtained from all the patients involved.

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