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ORIGINAL ARTICLE BREAST SURGERY

Mastopexy Autoaugmentation by Using Vertical and Triangular Flaps of Mammary Parenchyma Through a Vertical Ice Cream Cone-Shaped Approach

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Abstract

Background Mastopexy autoaugmentation by using an extended vertical flap and two transverse triangular flaps of mammary parenchyma was performed through an adjustable vertical ice cream cone-shaped approach.

Method A vertical rectangular flap with the length of the inferior pole and thickness of the mammary parenchyma was supported at the inframammary fold. Dissection of the vertical flap was extended underneath the areola until the projection of its upper limit, adding 4–5 cm to the length of the vertical flap. A triangular flap supported on its lower half with 4–6 cm long and thickness of the vertical pillar was dissected on both vertical pillars. Patients were followed up for 2 years.

Results The vertical rectangular flap filled the upper pole and central breast. The triangular flaps apart from filling the lower pole increased the mammary cone projection. The medial rotation advancement of the triangular flaps created a transverse support girdle at the lower pole, maintaining the vertical flap into position. In addition, fixation of the vertical flap along its entire length avoided long-term down-displacement of the breast. A keel resection of mammary parenchyma was performed in the larger breast in mild or moderate asymmetries.

Conclusion Mastopexy autoaugmentation through an adjustable vertical approach using vertical and triangular flaps of mammary parenchyma filled the upper pole and central breast and reshape the lower pole, recovering the breast contour. It provided long-term stabilization of the mammary cone without a breast implant or fat transfer.

Level of Evidence IV This journal requires that authors assign a level of evidence to each article. For a full description of these evidence-based medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords Mastopexy autoaugmentation · Vertical rectangular flap · Triangular flap · Vertical ice cream cone-shaped approach · Transverse girdle · Mammary parenchyma

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Introduction

Breast augmentation surgery is any procedure that enhances or restores the size, shape, and projection of the breasts. Augmentation mammaplasty is usually performed using silicone or saline breast implants [1]. Despite their wide use, complications regarding breast implants are not unusual. Capsular contracture is the most common complication that frequently requires revision surgery [2]. Recently, breast implant-associated anaplastic large cell lymphoma, even though a rare cancer, has been described in patients after breast augmentation [3]. Autologous fat transfer is another alternative for breast augmentation. It can be

applied either as a graft or as an injection [4]. Complications regarding fat transfer for breast augmentation have been also reported. Among them are fat necrosis, calcification, fat cysts, and deformity of the breast contour [5]. Another alternative to breast augmentation is mastopexy. This technique fills the empty upper pole of the ptotic breast, providing the appearance of an augmented breast, hence the term mastopexy autoaugmentation. It restores breast drooping from gravity, volume loss in the upper pole, and breast projection and prevents bottoming-out deformity [6]. Several types of pedicle orientations for the breast flaps have been developed in mastopexy autoaugmentation. The most common is the dermoglandular flap with an inferior pedicle. It redistributes the mammary parenchyma, filling the upper pole and increasing the central projection of the breast [7]. Medial and lateral pedicles for breast flaps are also employed to ensure the breast projection [8]. Several approaches to mastopexy autoaugmentation are described to combine the safety of the nipple–areola with short-scar techniques. The vertical approach in cosmetic breast surgery is a safe alternative to nipple–areola transposition with a short scar [9]. It is more frequently indicated for young patients with a moderate degree of breast ptosis and hypertrophy. Vertical mastopexy is also indicated for patients over 50 years of age with severe ptosis and large hypertrophy of the breasts [10]. Superomedial pedicle techniques to the nipple–areola complex are suitable to preserve the nipple–areola [11]. The remaining skin envelop to cover the breast in mastopexy with a vertical approach should be compatible with the reshaping of the breast volume [12].

Mastopexy autoaugmentation is proposed here using vertical and triangular flaps of mammary parenchyma through a vertical ice cream cone-shaped approach without the need for a breast implant or fat transfer.

Patients and Method

Eighty-six breasts of 43 females with ages ranging from 22 to 51 years old, mean age 38.51 years, and 1 to 3 pregnancies (average 1.44 pregnancies) had a compromise of shape, volume, and projection. An empty upper pole with enlargement of the lower pole and loss of the mammary cone projection were associated with mild and moderate degrees of breast hypertrophy and ptosis. Thirty-four patients had different degrees of breast asymmetry, and nine had no significant breast asymmetry. Criteria of exclusion were patients with breast hypotrophy, or large and severe breast hypertrophy and ptosis. Patients were followed up for a period of 2 years. All procedures performed in this study involving humans participants were in accordance with the ethical standards of the ACA - Institute of Assistance in Plastic Surgery of São Paulo research committee. Patients signed an informed consent form agreeing to the proposed treatment that was performed according to the 1964 Helsinki Declaration and Medical Research Involving Human Subjects and its later amendments or comparable ethical standards.

Marking

With the patient in sitting position, a nipple–clavicular line is drawn distant 6–7 cm from the sternal notch as the lateral displacement of the nipple–areola. Point **A** is the projection of the inframammary fold on the nipple–clavicular line. A circle with a diameter ranging from 8 to 10 cm is outlined from point **A**. The vertical diameter of the circle, line **AD**, is in continuity with the nipple–clavicular line undergoing through the nipple. The transverse diameter of the circle, line **BC**, is displaced 1–2 cm downward, creating the line $\mathbf{B^1C^1}$ and point $\mathbf{D^1}$ in the intersection with the line **AD**. The length of the circle diameter and down-displacement of its transverse diameter were established according to the degree of breast ptosis and hypertrophy. The inverted U-shape achieved by binding points $\mathbf{B^1}$, **A,** and $\mathbf{C^1}$ set the new location and diameter of the areola. The length of the vertical diameter is displaced downward from point $\mathbf{D^1}$ toward the inframammary fold, marking point $\mathbf{D^2}$ at its distal end. From point $\mathbf{D^2}$, two curve lines with concavity turned over the vertical diameter are directed to points $\mathbf{B^1}$ and $\mathbf{C^1}$. Concavity of the lines $\mathbf{B^1D^2}$ and $\mathbf{C^1D^2}$ is more pronounced; the greater the breast ptosis and hypertrophy, can reach more than 10 cm. The final design of the vertical approach is an ice cream cone shape (Fig. 1).

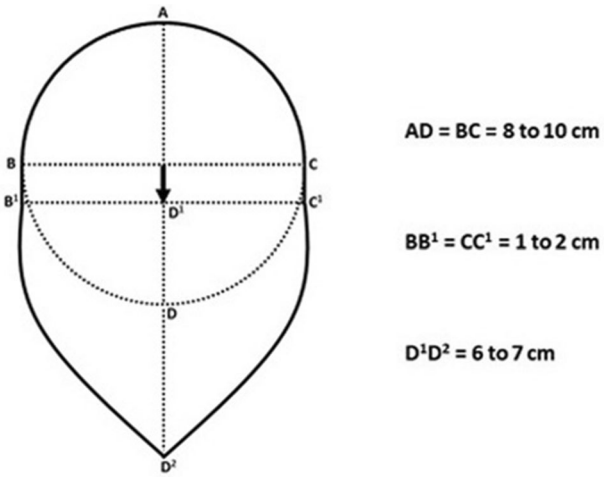

Fig. 1 Diagrammatic representation and measurements of the marking

Operative Technique

The periareolar area is deepithelized, and the skin inside the ice cream cone shape is resected. A vertical rectangular flap is drawn inside the vertical approach with the pedicle at the inframammary fold (Fig. 2). Dissection of the vertical flap is extended underneath the areola until its upper limit, adding 4–5 cm to the length of the vertical flap (Fig. 3). A medial keel-shaped resection of mammary parenchyma is made at the upper pole of the largest breast in mild or moderate asymmetries. A subglandular tunnel over the pectoralis fascia toward the second intercostal space accommodated the vertical rectangular flap. The tip of the elongated vertical flap is up-displaced and fixed on the pectoral fascia at the third rib and the flap lateral edges fixed on the pectoral and serratus fascias (Fig. 4). Dissection of the vertical flap creates two vertical pillars in the lower pole of the breast. An oblique line is drawn from the half of the vertical pillar at the cutaneous incision to its cut edge at the areola (Fig. 5). A full-thickness incision of the oblique line creates a triangular flap supported on the lower half of the vertical pillar with 4–6 cm long and thickness of the vertical pillar (Fig. 6). Medial rotation advancement of the triangular flaps allowed its crisscrossing over the vertical flap. The crisscrossing of the triangular flaps, with the medial flap above the lateral flap, creates a transverse support girdle at the lower pole of the breast (Fig. 7). The tips of the triangular flaps were anchored 2–4 cm farther from the edges of the vertical flap on the pectoralis fascia, and the two flaps were sutured together along their entire length. The approach of the vertical pillars changed the curve lines $\mathbf{B^1D^1}$ and $\mathbf{C^1D^1}$ into a straight line.

Fig. 2 Vertical rectangular flap marked from the areola to inframammary fold

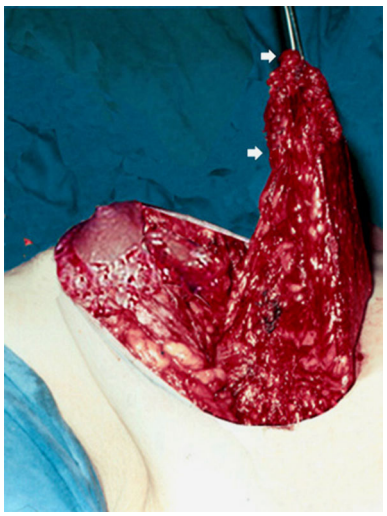

Fig. 3 The arrows point the length of the retroareolar mammary parenchyma added to the vertical rectangular flap

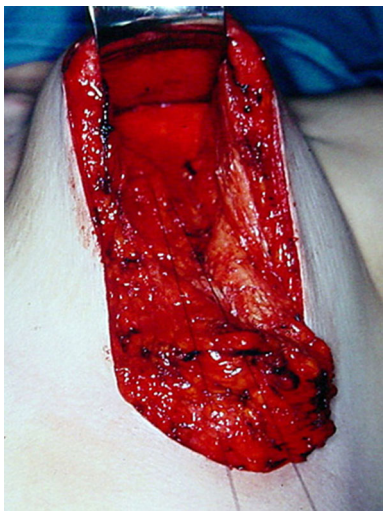

Fig. 4 The tip of the vertical flap is fixed on the pectoralis fascia at the third rib

Results

Eighty-six breasts of 43 females underwent mastopexy autoaugmentation by using a vertical flap and two triangular flaps through a vertical ice cream cone-shaped approach. Twenty-three patients had small asymmetry, eleven moderate asymmetry, and nine no significant asymmetry. Thirteen patients had mild hypertrophy, and thirty patients moderate hypertrophy. Fifteen patients had mild ptosis, and twenty-eight moderate ptosis. Medial rotation advancement of the triangular flaps reduced the breast circumference, increasing the mammary cone projection and fulfilling the lower pole. Up-displacement of the vertical flap filled the upper pole and central breast, contributing to the mammary cone projection. Medial

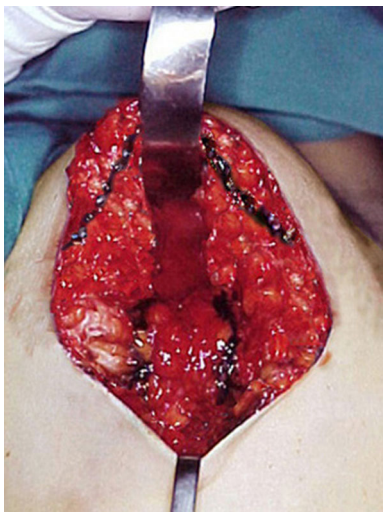

Fig. 5 An oblique line is drawn from the half of the vertical pillar at the cutaneous incision to its cut edge at the areola. The vertical flap is fixed along the pectoral fascia

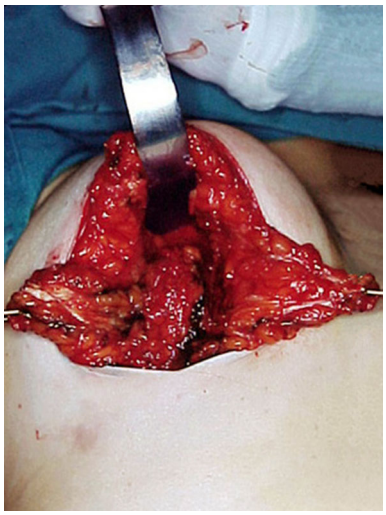

Fig. 6 Transverse triangular flaps supported on the lower half of the vertical pillars

rotation advancement of the triangular flaps associated with up-displacement of the vertical flap reshaped the mammary parenchyma, providing the appearance of an augmented breast (Fig. 8). Improvement in the upper and lower pole contours with the increase in the mammary cone projection was maintained in the appraisal period (Fig. 9). Seventy-five breasts underwent mastopexy autoaugmentation without resection of mammary tissue (Fig. 10). Eleven breasts had resection of mammary tissue, ranging from 183 to 347 g (average 261.63 g) (Fig. 11). The ice cream cone-shaped approach resulted in a vertical straight line, ranging from 6 to 8 cm long (average 6.42 cm). Twenty-nine patients had a 6-cm-long straight vertical scar, ten patients

Fig. 7 Transverse girdle of mammary parenchyma achieved by crisscrossing the medial triangular flap above the lateral triangular flap at the lower pole of the breast

Fig. 8 Noticeable improvement of the left breast in relation to the flattened right breast, characterized by fullness of the upper pole and central breast with projection of the mammary cone, reduction of the base diameter, and 6-cm vertical straight scar

7-cm-long, and four patients 8-cm-long. Table 1 summarizes patient distribution and outcomes.

Discussion

As the breast tissue descends inferiorly with gravity, there is a volume loss in the upper pole and central breast, and the lower pole becomes fuller and wider. Mastopexy redistributes the breast tissues, mobilizing mammary parenchyma from the area where there is excess to the area where there is a deficit [13]. Increased mammary cone projection by the vertical flap and rotation advancement of the triangular flaps added to a decrease of the breast diameter through the triangular flaps crisscrossing, provided the appearance of an augmented breast. The vertical flap of mammary parenchyma with inferior pedicle is

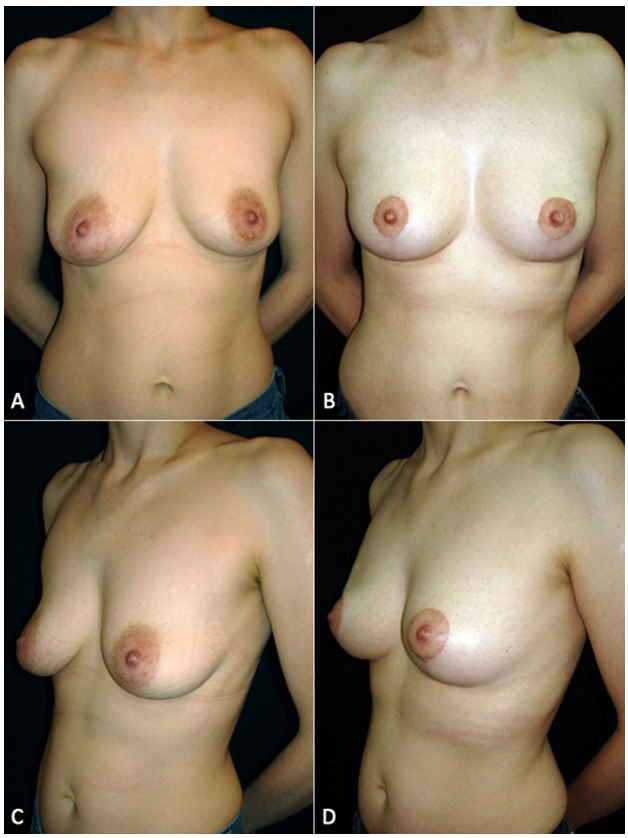

Fig. 9 **a–c** Mild breast asymmetry in a 29-year-old woman with emptying of the upper pole and central breast. **b–d** Mastopexy autoaugmentation without resection of mammary parenchyma maintained the appearance of an youthful breast at 2 years postoperatively

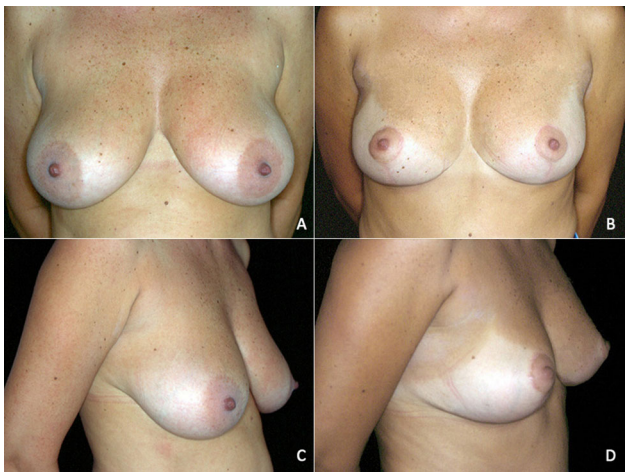

Fig. 10 **a–c** A 47-year-old woman with moderate hypertrophy, mild ptosis, and no significant breast asymmetry underwent mastopexy autoaugmentation without resection of mammary parenchyma. **b–d** Lift of the breast with recovery of the mammary cone and breast contouring at 2 years postoperatively

widely used to project the upper and lower poles of the breast [14]. However, its length not always is long enough

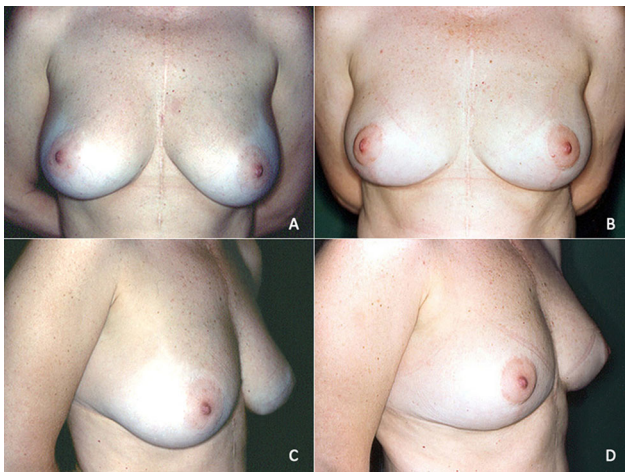

Fig. 11 **a–c** A 44-year-old woman with a moderate degree of ptosis and hypertrophy, and small breast asymmetry underwent mastopexy with reduction of 183 g in the left breast. **b–d** At 2 years postoperatively a suitable balance of the upper and lower pole, and central breast

to reach the third rib, being attached on the pectoral fascia under tension. The down-traction of the vertical flap over time disrupts the stitches, causing the flap to slide downward, emptying the upper pole. The addition of 4–5 cm of the retroareolar tissue to the length of the vertical flap allowed its fixation on the third rib without tension, thereby ensuring long-term filling of the upper pole and central breast. To obtain a predictable and long-lasting stable breast shape by avoiding bottoming-out, fixation and retention of the vertical flap to the chest wall are imperative [15]. The vertical flap fixed in the pectoral and serratus fascias from the third rib to the inframammary fold stabilized long-term projection of the mammary cone. Apart from the fascial fixation, other types of support have been proposed to hold the vertical flap in position. Among others, a loop of the pectoralis muscle is reported; however, it can flatten the lower pole during muscle contraction, due to the pressure exerted by the muscle over the vertical flap [16]. Differently, a transverse support band of breast tissue does not compromise the vertical flap and avoids its down-displacement [17]. In this series of patients, the criss-crossing of the triangular flaps created a transverse girdle of mammary parenchyma holding the vertical flap into position without pressuring it. The medial rotation advancement of the triangular flaps noticeably reduced the breast circumference, increasing the mammary cone projection. In addition, it provided a balanced contour for the upper and lower pole of the breast. Mastopexy with vertical skin patterns is more commonly used for managing mild to moderate ptosis and hypertrophy of the breast [18]. The adjustable marking of the circle diameter, down-displacement of the transverse diameter, and degree of the concavity of lines $\mathbf{B^1D^1}$ and $\mathbf{C^1D^1}$ allowed the use of the

Table 1 Patient distribution and outcomes

	Pregnancy	Age	Asymmetry			Hypertrophy		Ptosis		Tissue resected (g)		Scar (cm)
			Small	Moderate	No significant	Mild	Moderate	Mild	Moderate	Right	Left	
1	1	29	−	+	−	−	+	−	+	−	302	8
2	1	43	−	+	−	−	+	−	+	−	290	8
3	2	26	−	−	+	−	+	+	−	−	−	6
4	1	29	+	−	−	+	−	−	+	−	−	6
5	1	44	+	−	−	−	+	−	+	−	183	6
6	2	30	−	+	−	−	+	−	+	194	−	7
7	1	32	+	−	−	+	−	+	−	−	−	6
8	2	44	−	+	−	−	+	−	+	−	−	7
9	1	27	+	−	−	−	+	−	+	−	−	6
10	2	39	−	−	+	+	−	+	−	−	−	6
11	3	48	−	+	−	−	+	−	+	−	285	8
12	1	22	+	−	−	−	+	−	+	−	−	7
13	1	35	+	−	−	−	+	−	+	−	−	6
14	1	43	+	−	−	+	−	+	−	−	−	6
15	2	44	+	−	−	+	−	+	−	−	−	6
16	2	48	−	+	−	−	+	−	+	296	−	7
17	1	40	+	−	−	−	+	−	+	−	−	6
18	2	49	+	−	−	−	+	−	+	−	−	6
19	1	49	−	−	+	+	−	+	−	−	−	6
20	1	39	+	−	−	+	−	+	−	−	−	6
21	2	51	−	+	−	−	+	−	+	347	−	8
22	1	29	−	+	−	−	+	−	+	257	−	7
23	1	27	−	+	−	−	+	−	+	−	236	7
24	2	42	+	−	−	−	+	−	+	−	−	6
25	1	44	+	−	−	+	−	+	−	−	−	6
26	2	47	−	−	+	−	+	−	+	−	−	6
27	2	39	−	−	+	+	−	+	−	−	−	6
28	3	51	−	−	+	−	+	−	+	−	−	6
29	1	28	+	−	−	+	−	+	−	−	−	7
30	1	45	+	−	−	−	+	−	+	−	−	6
31	1	45	+	−	−	−	+	−	+	−	−	6
32	3	47	+	−	−	−	+	−	+	−	−	7
33	1	36	+	−	−	−	+	+	−	−	−	6
34	1	41	−	−	+	−	+	−	+	−	−	6
35	2	45	−	+	−	−	+	−	+	−	259	7
36	1	28	+	−	−	−	+	+	−	−	−	6
37	2	37	+	−	−	−	+	−	+	−	−	6
38	2	41	−	−	+	−	+	−	+	−	−	6
39	1	40	+	−	−	+	−	+	−	−	−	6
40	1	41	−	+	−	−	+	−	+	−	218	7
41	1	22	+	−	−	+	−	+	−	−	−	6
42	2	48	+	−	−	−	+	−	+	−	−	6
43	1	22	−	−	+	+	−	+	−	−	−	6

vertical ice cream cone approach for mild or moderate breast hypertrophy and ptosis. Orientation of the nipple–areola pedicle attempts to maximize both vascularity and sensation to the nipple–areola. The nipple–clavicular line is a natural course for transposition of the nipple–areola [19]. The vertical diameter of the ice cream cone-shaped

approach undergoing through the nipple and in continuity with the nipple–clavicular line ensured safe transposition without distortion for the nipple–areola.

Conclusion

Mastopexy autoaugmentation by up-displacement of the elongated vertical flap and medial rotation advancement of the triangular flaps through an adjustable vertical ice cream cone-shaped approach reshaped the breast, providing the appearance of an augmented breast without the need of a breast implant or fat transfer.

Compliance with Ethical Standards

Conflict of interest No financial support or benefits have been received by the author or any co-author to accomplish this manuscript.

Ethical Approval All procedures performed in this study involving human participants were in accordance with the ethical standards of the ACA - Institute of Assistance in Plastic Surgery of São Paulo research committee and with the 1964 Helsinki Declaration and Medical Research Involving Human Subjects and its later amendments or comparable ethical standards.

Informed Consent Patients signed an informed consent form agreeing to the proposed treatment.

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