

Refinements of Vertical Scar Mammoplasty: Circumvertical Skin Excision Design With Limited Inferior Pole Subdermal Undermining and Liposculpture of the Inframammary Crease

Bishara S. Atiyeh, M.D., F.A.C.S., Michel T. Rubeiz, M.D., F.A.C.S., and Shady N. Hayek, M.D.

Beirut, Lebanon

Abstract. Vertical scar mammoplasty, first described by Lötsch in 1923 and Dartigues in 1924 for mastopexy, was extended later to breast reduction by Arié in 1957. It was otherwise lost to surgical history until Lassus began experimenting with it in 1964. It then was extended by Marchac and de Olarte, finally to be popularized by Lejour. Despite initial skepticism, vertical reduction mammoplasty is becoming increasingly popular in recent years because it best incorporates the two concepts of minimal scarring and a satisfactory breast shape. At the moment, vertical scar techniques seem to be more popular in Europe than in the United States. A recent survey, however, has demonstrated that even in the United States, it has surpassed the rate of inverted T-scar breast reductions. The technique, however, is not without major drawbacks, such as long vertical scars extending below the inframammary crease and excessive skin gathering and “dog-ear” at the lower end of the scar that may require long periods for resolution, causing extreme distress to patients and surgeons alike. Efforts are being made to minimize these complications and make the procedure more user-friendly either by modifying it or by replacing it with an alternative that retains the same advantages. Although conceptually opposed to the standard vertical design, the circumvertical modification probably is the most important maneuver for shortening vertical scars. Residual dog-ears often are excised, resulting in a short transverse scar (inverted T- or L-scar). The authors describe limited subdermal undermining of the skin at the inferior edge of the vertical incisions with liposculpture of the inframammary crease, avoiding scar extension alto-

gether. Simplified circumvertical drawing that uses the familiar Wise pattern also is described.

Key words: Circumvertical mammoplasty—Reduction mammoplasty—Vertical scar mammoplasty

Reduction mammoplasty is one of the more frequent procedures in plastic surgery [9,67]. Patients with large breasts usually are motivated by a desire to get rid of the physical symptoms including back and neck pain, shoulder grooving, intertrigo, and coracoid compression syndrome [8,16].

More recently, the psychological aspects of large breasts have become increasingly important [32]. Many women are in fact more embarrassed by comments related to their breasts than by their physical discomfort [16]. Most may experience a variety of psychosocial problems such as low self-esteem, fears of sexual harassment, difficulty with sports and exercise, and limited clothing or brassiere options. Younger patients usually do not incorporate their large breasts into their body image [16] and will benefit particularly by enhancement of their self-confidence, view of their femininity, and sexual attractiveness [26]. Poor posture associated with macromastia, on the other hand, could be a symptom of the increased load on the skeletal system, but also may be a mimic to hide disfiguring large breasts [16].

The main goal of reduction mammoplasty is therefore to alleviate physical, emotional, and psychosocial discomfort [8,9,31,67]. It also should not be overlooked that patients seeking help for breast reduction often are very young and probably plan to have children later in their lives. It is most important

Correspondence to B. S. Atiyeh M.D., F.A.C.S., Division of Plastic and Reconstructive Surgery, American University of Beirut Medical Center, Beirut, Lebanon, ; *email*: aata@terra.net.lb

therefore to offer them a method of reduction mammoplasty that leaves as little scarring and as much physiologic function as possible [60].

Appropriate reduction of breast size, symmetric and youthful breast shape with good projection, minimal and inconspicuous scars, and preservation of lactation and breast sensitivity with stable, long-lasting results all are attributes of a successful reduction mammoplasty [32,67]. Achieving these goals is a challenge for every plastic surgeon, as evidenced by the multitude of techniques and modifications that vary in terms of scar position and length, pedicle choice, and breast-forming methods [55].

Reduction mammoplasty has evolved dramatically since its introduction [9,67], and a large number of technical variations and modifications have been proposed in the literature [16,29,32,67]. The search for a reliable method to transpose the nipple–areola complex without complete amputation and subsequent grafting has marked the history of breast reduction techniques [20].

The evolution of pedicled techniques allowed reduction mammoplasty to become a safer and more reliable operation [9]. After 1960, surgeons abandoned the wide skin and glandular undermining operations (i.e., the Biesenberger[6] technique) for pedicle techniques. Arié [1] and Pitanguy [59] used a superior pedicle, and Strömbeck [66] in 1959 described a dermal horizontal bipedicle. In 1963, Skoog [64] made further modifications favoring the lateral cutaneous pedicle. He later made the pedicle thicker to ensure more reliable circulation. The vertical bipedicle method described by McKissock [48] became popular in the 1970s. In the 1980s and 1990s, many surgeons in North America adopted the inferior pedicle technique [11,63] because of its ease of performance and reliability. Concomitant with acceptance of the inferior pedicle was adoption of the Wise pattern, which is based on a brassiere design for the skin markings, resulting in an anchor-shaped inverted T-scar [68].

In North America, most breast reductions are performed using some variation of the modified Robbins technique with Wise pattern markings in which the skin is redraped around an inferior breast pedicle and closed in an anchor-shaped closure [8,9,18,20,62,63]. These two cutaneous and glandular components of breast reduction have become the standard against which other techniques are measured [68]. Numerous reports have established the efficacy of inverted T-scar methods [11,15,22,24,28,43,48,63].

Although the Wise pattern is easy to teach to young plastic surgeons and gives more reproducible results [62,68], the inverted T-incision mammoplasty with its long, often clearly visible scars, particularly in the cleavage can no longer be accepted as the standard technique [16]. Moreover we all have been taught to keep the vertical limb of the anchor-shaped scar near to 5 cm [20]. As Lassus [37] pointed out, this

dogma needs to be reconsidered. In normal women with attractive breasts, the distance ranges between 4.5 and 10 cm [37]. On the other hand, most T-incision techniques do not achieve a glandular base reduction, currently considered to be essential for proper breast shape. The outcome usually is a cone with a broader, flatter shape and poor projection [18,55,61]. Boxy breast shape and lack of projection may be attributes inherent to short vertical limbs of the Wise design [12,46,62].

Along with continuous technical advances that have contributed to a well-established increase in safety, reliability, and aesthetic outcome of reduction mammoplasty, the expectations of patients have changed accordingly [24,32]. Whereas older women who have experienced chronic back pain, inframammary intertrigo, and impaired physical activity for many years often are reluctant to accept the visible sequelae of surgery, younger women frequently are more apprehensive about the prospect of trading large breasts without scars for smaller breasts with visible and sometimes unsightly scars [32]. Moreover, patients requiring primary correction of ptosis and seeking improvement of their aesthetic appearance are even more worried about scars than patients with large breasts [16].

Although most patients find the standard procedure very satisfying, have their general expectations fulfilled, exhibit physiologic improvements, and experience relief of psychological distress, one-third still find the resulting scars unacceptable [7,27,67]. Long and conspicuous inframammary scars remain one of the more difficult aesthetic problems [67], and patients frequently are dissatisfied with the transverse inframammary scars associated with the common Wise pattern inverted T-shape closure [9,20]. These undesirable scars can be quite long, extending medially and laterally beyond the boundaries of the brassiere [8]. They are very susceptible to hypertrophy and widening, becoming visible and unsightly, particularly at the medial and lateral extensions [8,12,36,39,62]. The psychological impact of these scars should not be underestimated [32,41].

Absence of scars in the visible part of the cleavage is the desire of every patient, and clinicians must take this wish into account when deciding which of the currently available reduction mammoplasty techniques is appropriate [55], particularly for younger women who usually tend to scar more easily, or for dark-pigmented women (e.g., African American or Southeast Asian women) who may be prone to keloid formation [54]. Dehiscence or delayed healing that may occur at the confluence of the inverted T, especially with larger reductions, is another drawback of this design, in addition to overreliance on the skin envelope, a constant characteristic of the inverted T techniques that may lead to pseudoptosis or a bottoming out of the breast shape over time. The widened, flattened breast mound, supported only by the redraped skin flaps, usually is unattractive [8].

A 1987 survey involving all members of the American Society of Plastic and Reconstructive Surgeons found that 11% of respondents had been sued by patients dissatisfied with the outcome of their breast reduction. The appearance of scars was the most commonly cited reason for litigation [8,25].

Because of the many drawbacks associated with T-incision reduction mammoplasties, some procedures have been proposed to minimize the infra-mammary scarring and decrease the vascular risk of the flaps [22,38,47]. These procedures include the B-technique (Parenteau and Renault, 1989; Renault, 1980), Z-mammoplasty (Maillard, 1986), L-shaped limited scar (De Longis, 1986), sculpturing of the breast from the undersurface (Berrino et al., 1988), liposuction and periareolar reduction (Courtiss, 1993; Felicio, 1991; Toledo and Matsudo, 1989), the circular folded pedicle technique (Reno, 1992), and S-approach reduction mammoplasty (Tien-Hsing Chen, 1994) [22,38,47,67]. The Chiari Junior [10] technique is another newly described method that results in an L-shaped scar. It is undoubtedly a method with complex markings not easy to understand when first seen [47].

Over the past decade, two major techniques have developed from a new tendency toward short incisions for breast reductions [52]: the vertical reduction method and the "round-block" periareolar technique popularized by Benelli and others [4,14,17]. These have emerged as alternatives.

Vertical scar mammoplasty, first described by Lötsch in 1923 [42] and Dartigues in 1924 [13] for mastopexy, was later extended to breast reduction by Arié [1] in 1957. It was otherwise lost to surgical history until Lassus [37] began experimenting with it in 1964. It then was extended by Marchac and de Olarte [44] and later refined and popularized by Lejour [3,8,36,37,39–41,55].

Although the vertical scar breast reduction technique still is met with skepticism because of its long learning curve and inconsistent results, its use is slowly gaining in popularity [9,62]. It is gradually becoming a more accepted alternative to traditional inverted T-scar methods [24]. However, the vertical scar and periareolar techniques have not become widely accepted by surgeons in the United States [62]. At the moment, vertical scar techniques seem to be more popular in Europe than in the United States [3]. Nevertheless, vertical reduction mammoplasty is becoming increasingly popular in recent years because the technique best incorporates the two concepts of minimal scars and a satisfactory breast shape [32]. A 2001 survey among American surgeons showed that vertical scar breast reduction was performed for 53% of U.S. patients and has surpassed the rate for inverted T-scar breast reductions [49].

The two alternative methods leave a shorter transverse scar, eliminate it completely, or even eliminate the horizontal and vertical scars altogether [4,8,14,17,24,32,37,40,41,44]. However, each method

has its own drawbacks. Wide circumareolar skin excision, in particular, has had limited appeal because of its inherent disadvantages including prominent periareolar scars, distorted areolar shape, loss of areolar skin texture, and central flattening of the breast [24]. Current criticisms of vertical mammoplasty include problems with poor immediate postoperative appearance, nipple–areola complex malposition, and excessive lower pole length.

Vertical mammoplasty also can result in other problems, such as hypertrophic circumareolar scars and lower pole deformities, including notching, boxy shape, infra-areolar depression, and flatness [23]. It is a procedure that has been characterized as difficult to learn and variable in outcome [9]. In an effort to simplify the technique and expand its applications, recent modifications to the basic vertical scar design have been introduced by Hall-Findlay [20], Hammond [21], and Spear and Howard [65], who have proposed alternative pedicles compatible with the vertical reduction patterns. The superomedial and inferior pedicle designs may be more versatile than the superior pedicles of Lejour and Lassus in terms of improved blood supply, innervation, and potential for postoperative lactation [65].

After training and familiarization with a Wise pattern inverted T method, it can be a daunting challenge to implement the vertical reduction technique [8,58]. Many authors have made this effort to reduce scarring [18]. Key features of vertical scar reduction mammoplasty include skin excision in only one direction, which reduces scar burden and improves surgical efficiency, as well as central and inferior vertical glandular excision, which contributes to improved postoperative shape by narrowing the breast base while maximizing projection as a result of suturing the medial and lateral pillars together. There is no wide periareolar skin excision, so circumareolar scar quality is not compromised by excess tension [24]. With Lejour's method, most of the skin excision is planned in the vertical component of the design, and the length of the periareolar skin incision is held constant according to the mathematical model in which incision line length equals areolar circumference: $2 \times [\pi] 5 r$ (r : areolar radius) [24].

Although the long-term results obtained from vertical reduction mammoplasty may seem promising, the immediate postoperative result often is not aesthetically pleasing [8]. Commonly, it is difficult to assure a patient that ultimate breast appearance will improve, particularly if the surgeon lacks experience with the method [8]. This may be one of the most compelling reasons not to attempt a vertical reduction mammoplasty [8]. Moreover, the vertical scar very often appears too long despite vertical wound closure with a skin-gathering technique (Fig. 1), extending sometimes below the new higher sub-mammary crease, and possibly becoming visible. This probably is the biggest pitfall of the vertical scar technique. It is vexing to the surgeon and, more

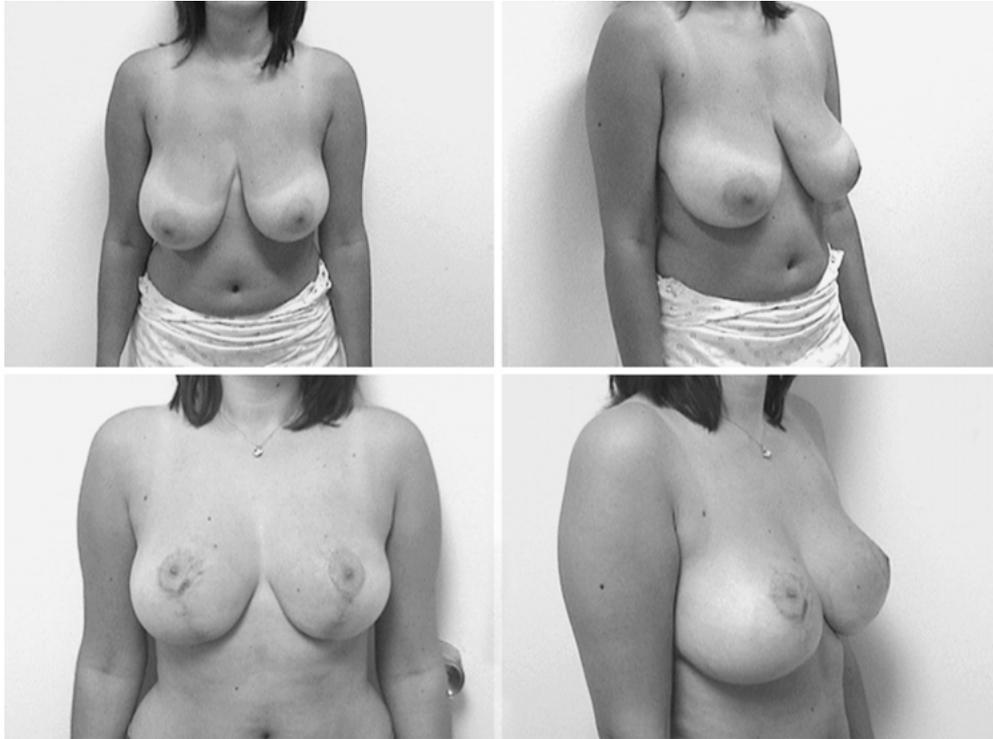


Fig. 1. Standard Lejour mammoplasty resulting in excessive lower pole length and long vertical scar.

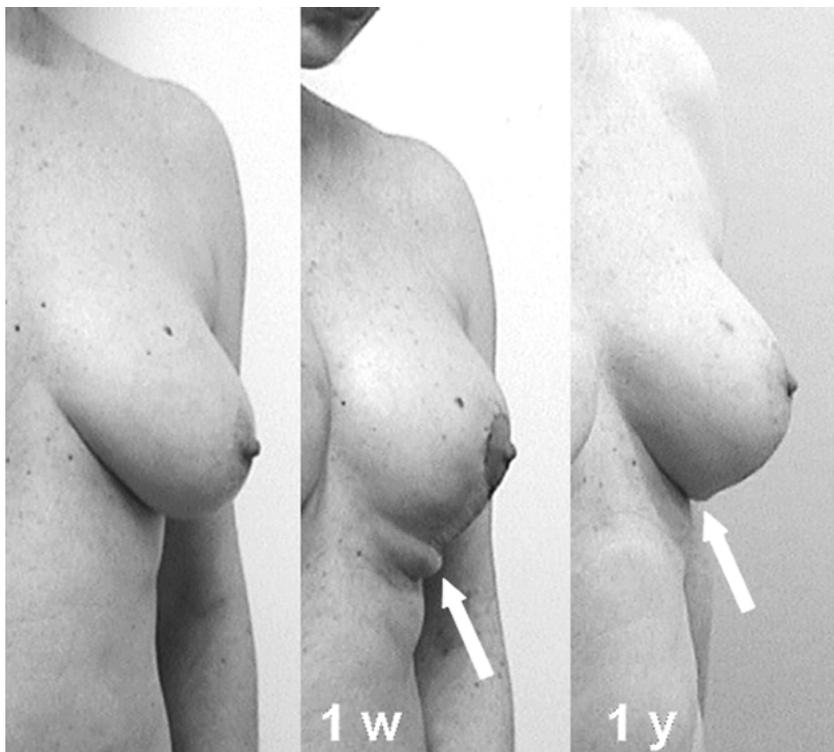


Fig. 2. Skin redundancy at the level of the new submammary crease forming a “dog-ear” not completely resolved after 1 year (arrows).

important, embarrassing to the women when wearing a small bra or bikini [3,60]. Moreover, the technique always produces marked puckering of the excess skin

with persistent marked “dog-ears” evident at the inferior portion of the vertical scar where skin is unsupported by breast tissue, particularly in large

volume reductions. The bulge results in a “double bubble” appearance, which may take a long time to resolve [65] (Fig. 2).

Although avoidance of a transverse scar is the goal of a vertical reduction pattern, a short, tidy transverse scar may be just as desirable as a purely vertical scar with irregularities or perhaps more desirable [65]. To avoid the potential need for future revision, a short horizontal incision may be used to treat the dog-ear in the operating room. Alternatively, it can be defatted and left to “settle” [65].

Another alternative is to convert the vertical scar into an L-scar by rotating the excess skin laterally around the corpus of the gland and placing the lateral extension of the scar in the submammary crease [55]. Revision of the vertical scar or a secondary, horizontally oriented excision of excess dog-ear tissue may be necessary in 16% to 28% of vertical scar breast reductions [5,9,55,60]. It has been suggested that a dog-ear at the end of the vertical scar may almost always be prevented by initial skin resection down to the submammary fold [60]. This, however, will undoubtedly extend the resulting scar caudally. As a result of these technical pitfalls, many plastic surgeons who attempted vertical reduction mammoplasty a few times in pursuit of excellent long-term outcomes have abandoned the technique in favor of procedures for which they were trained and are comfortable performing, usually some variation of the inferior pedicle T-shaped method [37] with more or less shorter transverse scars.

Recent efforts have been made to combine more traditional techniques of glandular resection with newer concepts of skin excision design [24]. One such method uses a Lejour-type skin excision pattern with a central pedicle design for glandular resection. This technique includes a peripheral glandular resection with internal suturing of the resected mound to maximize projection [19]. This differs conceptually from the standard vertical scar method in which central vertical resection followed by plication of the remaining medial and lateral glandular pillars narrows the base of the breast and maximizes projection [24].

A no-vertical-scar technique also has been described. This operation is almost the same as the inferior pedicle T-scar reduction. However, a small modification of the Wise pattern permits deletion of the vertical portion of the T-scar [35]. Several reports have addressed the no-vertical-scar breast reduction technique. Passot [57] usually credited for the first description of this operation in 1925. In the 1990s, Yousif and Larson [69] generated a resurgence of interest in this procedure. Several other authors also have described or discussed the method [35]. The no-vertical-scar breast reduction technique is not ideal for all types of breasts [35].

In an attempt to eliminate the pitfall of long vertical scars and inferior dog-ears while avoiding a short transverse scar, over the past 5 years, we have performed limited superficial subdermal undermining

at the lower border of the vertical suture line with liposculpture of the inframammary crease using our technique of vertical scar mammoplasty. This procedure combines Lejour’s technique of glandular resection and reshaping with a circumvertical skin excision design.

Markings and Surgical Technique

Preoperative markings are made with the patient in the standing position. The initial reference markings are the midsternal line extending into the navel, the midclavicular point (7 to 9 cm from the sternal notch), the existing submammary creases, and the nipple line—breast axis (from the midclavicular point down to the nipple, crossing the submammary crease approximately 10 cm from the midsternal line). The new higher position of the nipple is transposed on the breast axis at or immediately below the level of the existing inframammary fold. This results in an average distance of 18 to 22 cm between the suprasternal notch and the upper diameter of the areola, varying with the height of the patient and the desired breast size after reduction. A temporary periareolar incision line is drawn using a standard Wise pattern. The drawing then is modified by symmetric medial and lateral expansions. The drawing also is extended caudally on either side of the existing areola, resulting in a new periareolar drawing encompassing two times more areolar skin excision than the standard Wise drawing. Medial and lateral positions of the caudal ends of this periareolar drawing are estimated, depending on the anticipated skin excision, and checked by the pinching technique. On the average, the medial portion of this line is 9 to 11 cm from the midline, and the lateral portion is approximately 12 cm from the anterior axillary line. Vertical lines are subsequently drawn caudally from the lateral and medial ends of the periareolar drawing, then curved toward the breast axis line, where they meet about two fingers (2 cm) above the existing inframammary crease (Fig. 3).

An areolar 4 to 5 cm in diameter is determined on the operating table. The surgical procedure proceeds as a standard Lejour mammoplasty with an inferior glandular resection, superior dermoglandular pedicle for nipple—areola complex transposition, and medial and lateral pillars, however, without glandular liposuction. The breast mound is then formed by approximating the two pillars while reducing the base of the breast and elevating the inframammary fold. As with the Hammond technique, a key anchoring suture is placed to form the circle around the areola. Exact placement of this suture is, however, predetermined by preoperative markings and corresponds to the medial and lateral ends of the periareolar incision line. The areolar incision then is approximated by the placement of eight deep sub-

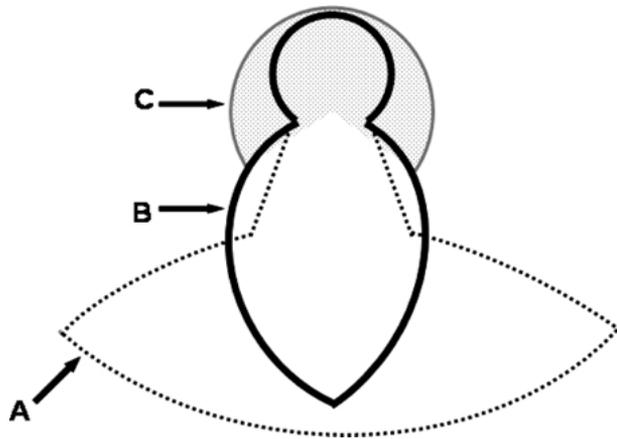


Fig. 3. (A) Inverted T mammoplasty design with Wise pattern. (B) Standard vertical mammoplasty design. (C) Circumareolar design with greater skin excision from the periareolar area.

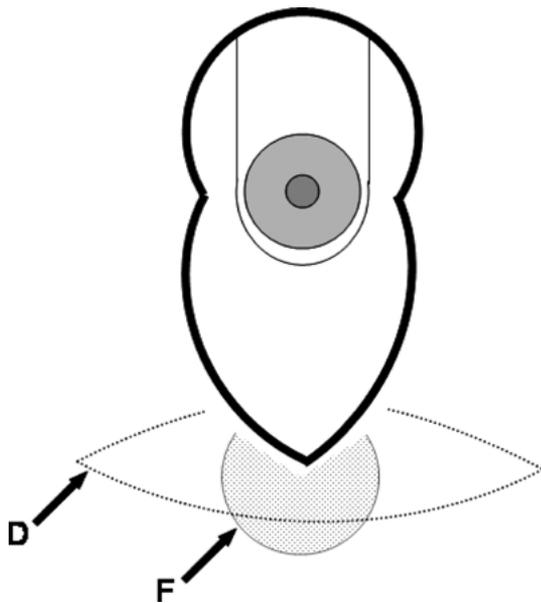


Fig. 4. Circumareolar design with superior dermoglandular pedicle for nipple–areola complex transposition. (D) Area of liposculpture. (F) Area of subdermal undermining.

cuticular sutures equally distributed. Subsequent placement of a nonresorbable round-block suture, as described by Benelli [4], is thus facilitated with even distribution of minimal skin pleating. Limited subdermal undermining of the skin at the lower end of the vertical incision line then is performed, allowing maximal skin retraction and facilitating the placement of the skin-gathering subcuticular suture, shortening the vertical scar and moving it cephalad. Residual fullness at the caudal end of the scar at the level of the new inframammary fold is finally corrected by liposculpture (Figs. 4, 5, 6, 7, and 8).

Discussion

Although vertical scar reduction mammoplasty is slowly gaining followers, efforts are being made to make it more user-friendly either by modifying it or by replacing it with an alternative that retains the same advantages yet is more predictable. Some of these newer techniques show promise. Although safe and easy to learn, they require more time for refinement before widespread application [5,24]. Several authors have reported vertical techniques that are conceptually similar to the standard technique yet vary in some details. Issues that differ among previous descriptions include the role of liposuction (integral or incidental), pedicle design (superior or medial), and whether or not to undermine the lower pole skin, imbricate the lower pole, or elevate the parenchyma by suture to the pectoralis major muscle [20,23,36,37,39,40].

Currently, complication rates for vertical scar mammoplasties compare well with those for T-scar reductions in the literature. Given that benefits of the vertical scar method are significantly greater (shorter scars and a significantly better, long-lasting breast projection), this technique is clearly justified to remain the standard method of reduction mammoplasty for the near future [3]. Certainly, with growing experience, problems can be avoided by adhering to proper patient selection, by using correct concepts of skin design, and by observing correct glandular resection and closure concepts [23]. The complication rates will diminish, and results will become more predictable and consistent.

Less scarring and a better, long-lasting shape are obtained with vertical mammoplasty [23] despite a recent comparative study based on photographic analysis that found no difference in the aesthetic outcomes between vertical reduction mammoplasty and the inferior pedicle Wise pattern mammoplasty [34]. Understanding of certain concepts and adoption of modifications to the standard technique also can prevent problems and eliminate the greatly compromised intraoperative and early postoperative aesthetic results that until now have been reluctantly accepted as an unavoidable aspect of the vertical mammoplasty technique [23].

Better long-term breast shape and projection produced by vertical scar reduction mammoplasties in most cases, regardless of the pedicle method used for nipple–areola complex transposition, need no more further elaboration provided the medial and lateral pillars are kept less than 8 to 9 cm in height. Tall pillars usually result in excessive lower-pole length [24,56]. Excess skin in the long vertical component of the design usually can be compensated with a subcuticular suture that shortens the vertical scar. The length of the caudal skin edges can be reduced sometimes from 15 cm to 6 or 7 cm [18,60].

In most cases, however, skin redundancy at the level of the new submammary crease forms a dog-ear

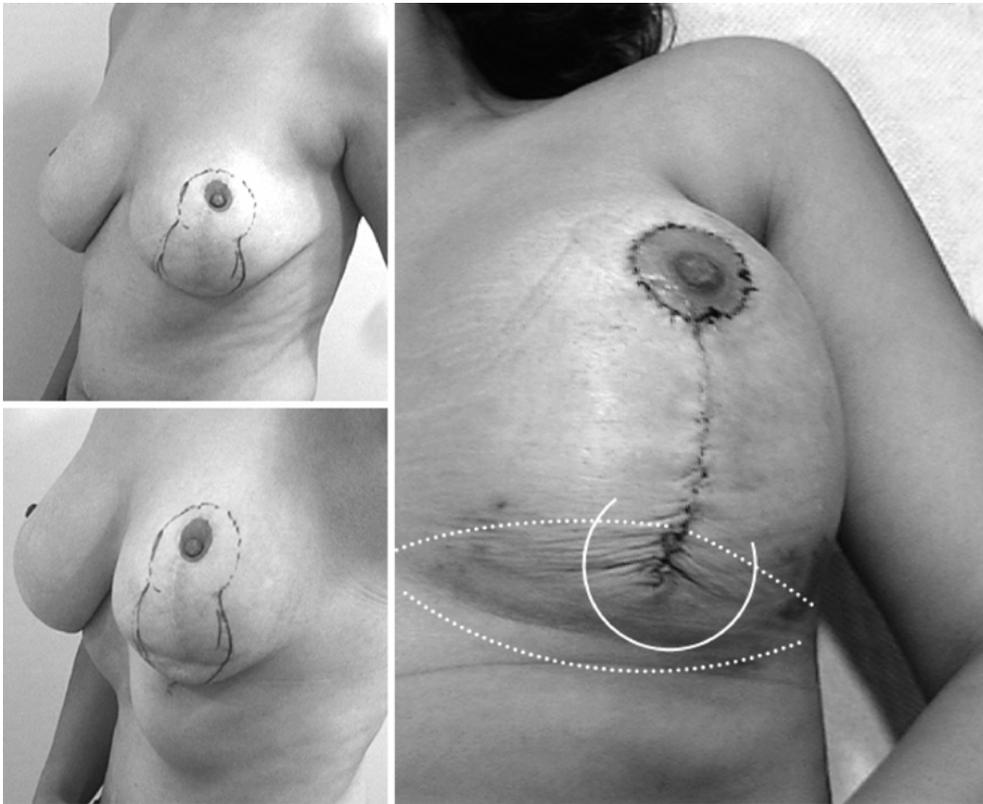


Fig. 5. Patient presenting 2 years after standard vertical mammoplasty for secondary correction of small irregular ANC, increased lower pole fullness, long vertical scar, and “dog-ear” that becomes exaggerated when the arm is elevated. Correction is performed with a circumvertical design and superior dermoglandular pedicle. The area of subdermal undermining and liposculpture is outlined. Maximal skin.

[18]. During the first 2 months of the postoperative period, the skin usually retracts, and no resection may be required, as suggested by Marchac and de Olarte [44]. Periareolar incision techniques, on the other hand, allow the excess skin to be resected from the periareolar area [17]. Wide circumareolar skin excision has had limited appeal because of its inherent disadvantages, which include prominent periareolar scars, distorted areolar shape, loss of areolar skin texture, and central flattening of the breast [24]. Moreover, the immediate resulting breast shape usually is not good, if not unaesthetic, and has only moderate areolar projection unless a mesh is fixed over the breast tissue [17].

Currently, it is possible to associate the two techniques in a circumvertical design, taking advantage of the positive features associated with the periareolar and vertical reduction techniques while minimizing their negative features. Vertical scar length may be reduced by compensating for the excess skin around the areola, avoiding scar elongation across the inframammary crease [18,52,62]. This method is conceptually the opposite of the Lejour method, in which most of the skin excision is planned in the vertical component of the design, and the length of the periareolar skin incision is held constant. The circum-

vertical variant removes most of the excess breast skin within the circumareolar portion of the incision design and less skin from the vertical wedge component [24]. An advantage of this method is that it does permit a much more accurate preview of the final result at the time of surgery than the Lejour method, in which a certain “leap of faith” is required [24]. We disagree with the suggestion that a design using the smallest possible circumference as a predetermined open periareolar design is better than a standard “mosque dome” design or other larger periareolar designs allowing greater periareolar skin excision. The claim that this conservative periareolar excision allows greater flexibility in determining final nipple position and reduces the risk of hypertrophic circumareolar scars [23], in our opinion, is not justified. Periareolar wound problems can be effectively avoided or minimized with a round-block suture placed around the areola to aid in skin closure, although with a small extrusion risk [18,24], instead of interrupted sutures or standard subcuticular suture (Fig. 9).

The “owl” incision described by Ramirez [62] combines the periareolar, vertical, and short horizontal incisions and adopts the features of both the large periareolar reduction (Benelli) and the vertical

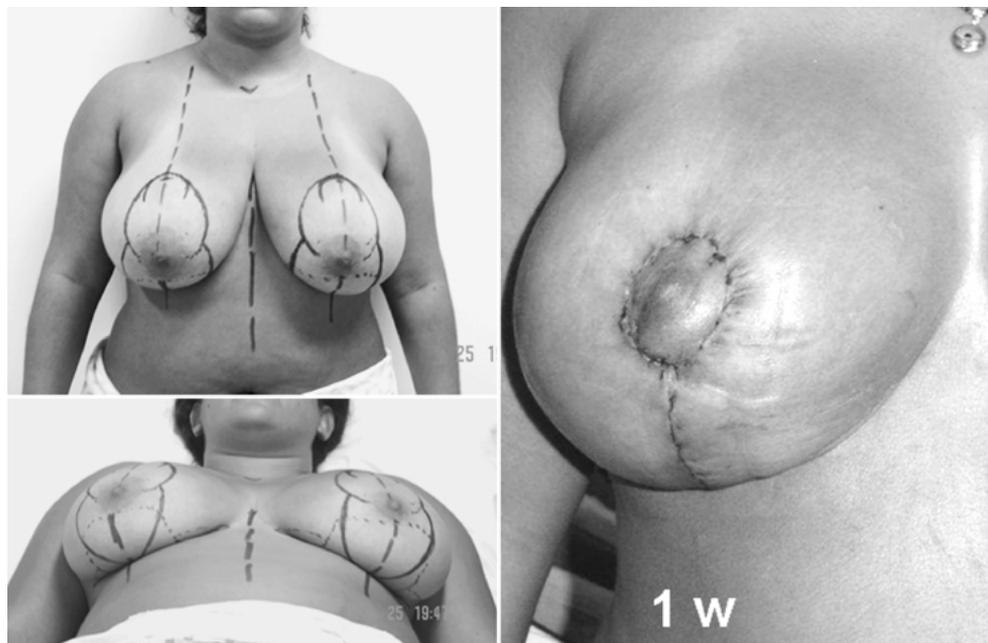


Fig. 6. Circumvertical reduction mammoplasty with inframammary crease liposculpture and limited inferior subdermal undermining. The periareolar incision is marked first with a standard Wise design. Then the drawing is modified symmetrically on either side of the breast axis. Next, the vertical component is drawn. The early postoperative result demonstrates good breast shape with minimal periareolar skin pleating.

reduction (Lassus/Lejour). With this technique, the horizontal inframammary scar is either made very short or completely eliminated. Enlargement of the periareolar skin resection diminishes the length and pleating of the vertical scar. Conversely, inclusion of the vertical component in the periareolar technique eliminates the excessive pleating effect of the periareolar incision. The short horizontal excision eliminates any resultant residual dog-ear in the new inframammary fold. Thus, the discrepancy in the lengths of scars is better distributed [62]. Small breast reductions and most mastopexies do not require this horizontal resection. For additional remodeling between the old and new inframammary folds, suction lipectomy of this area also has been described [62]. Additionally, aggressive debulking at the lower pole of the breast has been proposed to avoid this problem [9], but in our opinion, it is better replaced by more precise liposculpturing.

Similarly, the circumvertical technique described by Mottura [52] is a mixture of the periareolar and vertical techniques with regard to the skin incisions and final scars in which the skin resection is performed around the areola and continued in an inverted cone that starts at the infra areolar area and ends 2 to 4 cm above the submammary crease. Mottura observed that there is a harmonious distribution of the pleats around the areola and at the vertical wound, while at the same time all the breast skin is moved toward the areola and the vertical wound is elevated. The vertical suture should never cross the submammary crease.

This technique is a valid intermediate method and an alternative to both the periareolar and the vertical techniques. However, it does not address the problem of residual dog-ears and fullness that eventually may be observed at the lower end of the vertical component after the procedure.

On the other hand, the clamp technique using the special instrument described by Mitz [51] takes advantage of the skin vault and results in a single vertical scar, usually in a position where it can hardly be seen [33]. Vertical mammoplasty with a clamp technique is a natural progression of a technique using a superior pedicle to achieve a vertical scar. With it, there is no need for preoperative markings. The glandular tissue is removed after wide cutaneous undermining of the lower breast pole with constant reference to the breast base. The excess skin then is excised around the clamp, leaving only a vertical scar [33]. The lack of preoperative markings for vertical skin excision and the method described to determine the new position of the nipple, although described by Vladimir Mitz as the essence of “haute couture” with superior cosmetic results as compared with ready-made garments, is a major handicap of this technique because it relies entirely on the artistic sensitivity of the operator, which is impossible to reproduce.

In 1998, Hammond [21] described a short-scar periareolar inferior pedicle reduction mammoplasty to limit scarring while maintaining the safety and familiarity of the inferior pedicle for the nipple–areola complex. Another major advantage of

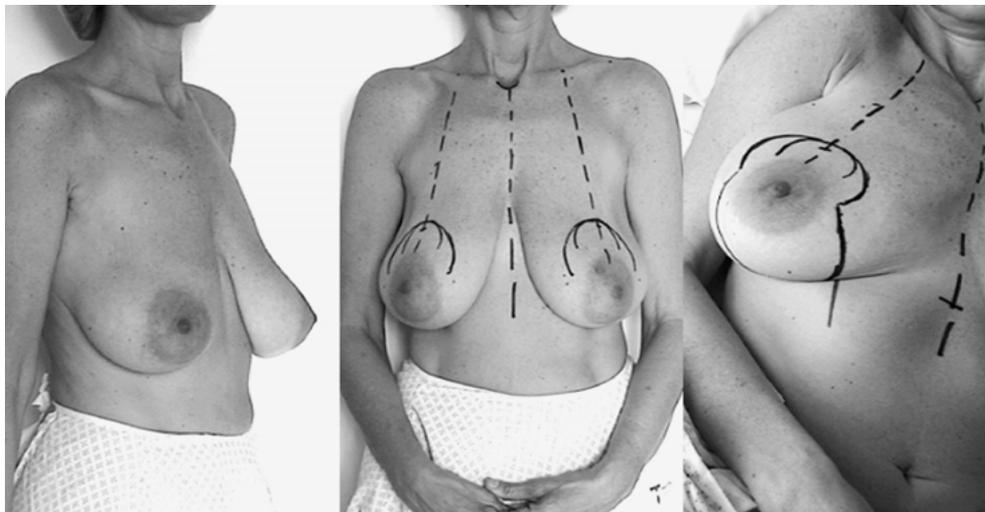


Fig. 7. Preoperative views with elaboration of skin markings.

this procedure is its combination of both the purse-string and vertical techniques for skin reduction rather than reliance on just one. With this technique, the vertical limb is closed with interrupted intradermal sutures. A running Gore-Tex purse-string closure is performed for the periareolar incision followed by intradermal closure. Although the Gore-Tex suture is soft and pliable, stable closure is entirely dependent on it. If it becomes disrupted, significant scarring or areola widening may occur. The incidence of periareolar scar widening with this type of closure is 17% [65]. It seems that the type of periareolar closure with this technique may be inferior to Benelli's round-block. The problem of persistent dog-ears also is not resolved.

All these modified techniques, including the one we present, address the pitfalls of the standard vertical reduction mammoplasty along the same conceptual principles. Some techniques have developed innovations to shorten the learning curve and further advance the vertical reduction mammoplasty as a method easily taught to teach residents [8]. Some also have modified the markings to make them straightforward and adaptable to different breast shapes and sizes without reliance on Wise pattern templates [8]. A main advantage of the described technique, in our opinion, is its easy markings using standard landmarks and adopting particularly the familiar Wise template, which is easily modified on the breast to encompass a greater periareolar skin excision.

Other described circumvertical techniques have less than straightforward markings. Mottura [52], for example, is satisfied with marking the superior border of the areola, then folding and lifting the breast. The amount of skin excision is determined subjectively, with the drawing of a periareolar circle guided to converge at the inferior quadrant in an inverted-cone form and finishing 2 to 4 cm above the submammary

sulcus. After glandular resection and reshaping, the skin is sutured together 8 to 10 cm above the inferior skin angle to form a circle around the areola above an inferior vertical ellipse. The position of this suture is not determined preoperatively.

On the other hand, Menke et al. [50] described a "closed" modified vertical scar technique in which the new areola position is not drawn preoperatively. It is determined at the operating table after the vertical scar has been closed. Hammond's markings, [21,65] drawn freehand, are rather complicated and confusing. With the vertical mammoplasty using the clamp technique, a breast meridian is subjectively determined regardless of the original nipple position. The nipple then is grasped and pulled down into the submammary fold. The breast becomes more compact. The new nipple position then is marked on the meridian 1 cm below the apex of the compact breast mound. After glandular resection and reshaping, the inferior skin is grasped by a special clamp determining the amount to be resected [33]. The success of this technique is highly dependent on the aesthetic sensitivity of the surgeon and is predominantly subjective. Markings proposed by Ramirez [62] are not only complicated, but also need to be checked against the pinch method described by Lassus and the mound displacement method described by Lejour.

Hall-Findlay [20] has already noted that although the vertical reduction mammoplasty has been described as too "intuitive," less precise, and more difficult to master [24], the markings actually are similar to the standard Wise pattern. Instead of extending the vertical limbs laterally and medially once the vertical limbs reach 5 cm, they are curved downward in a circular fashion to meet each other about 2 to 4 cm above the inframammary fold. Adherence to Lejour's directives [39,40] of keeping the length of the periareolar skin incision shorter than

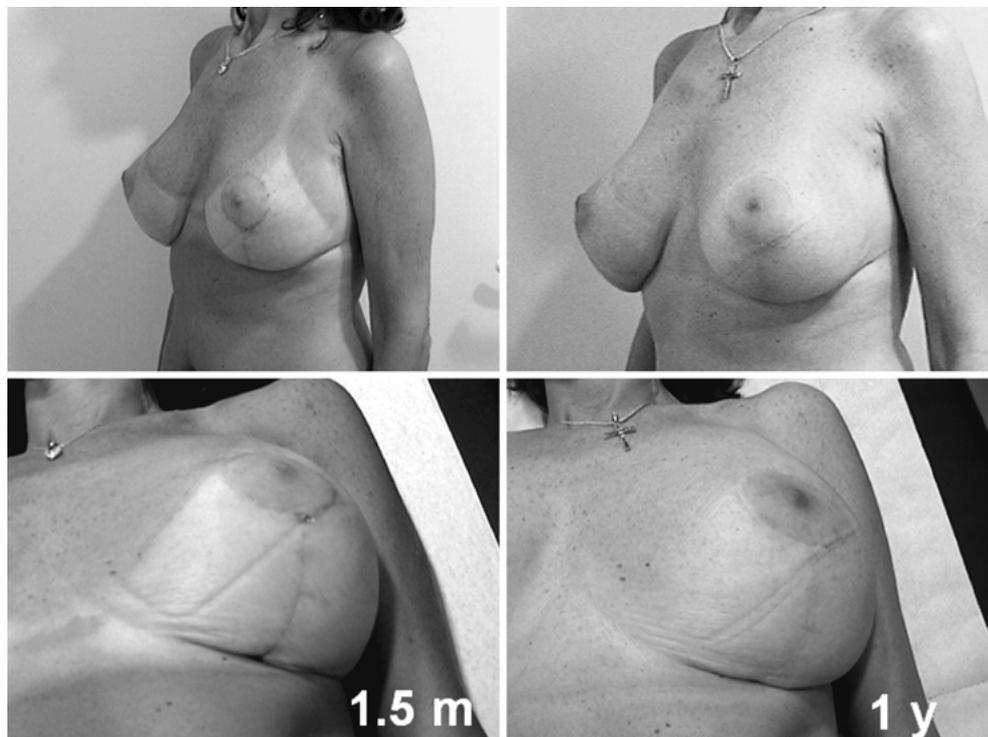


Fig. 8. Early and late postoperative results demonstrating stable good breast shape and projection without the stigma of the standard vertical technique. Excellent periareolar scar quality is shown without hypertrophy or stretching.



Fig. 9. Periareolar scars with circumvertical design and round-block suture.

16 cm (the same as the Wise pattern), which corresponds to the circumference of an areolar diameter of 4 and 5 cm, to avoid areolar scar stretching postoperatively has handicapped the vertical scar technique greatly.

Although these directives have been confirmed by other authors [32], the diameter of the periareolar incision can be doubled to reach an incision length of 30 cm without causing too much pleating whenever Benelli's round-block technique is being contemplated. The periareolar circle 8 to 12 cm in diameter described by Mottura [52] confirms this point. By

doing so, a significant amount of excess skin can be accommodated within the periareolar incision, reducing considerably the length of the vertical limbs.

Many authors continue to undermine the skin widely for adequate vertical skin closure [2,56]. This, however, may lead to wound-healing problems [23]. Undermining is not necessary for adequate skin gathering [20,23]. By performing glandular resection inferiorly as needed, even if the remaining skin flaps are still fairly thick, the flaps are sufficiently pliable for the excess skin in the vertical direction to be gathered easily without undermining along the full

length of the vertical scar with a continuous, subcuticular 3-0 suture even in the presence of a pedicle base, as is the case with a superomedial dermoglandular pedicle for nipple–areola complex transposition. Because of skin elasticity and retraction, the vertical scar after the dermis has been sutured actually is significantly shorter than that measured preoperatively with the patient standing. The skin usually is gathered to measure one-half to two-thirds of the length measured after the deep dermal sutures have been placed [20]. It also has been suggested that proper management of the vertical incision may be accomplished by restricting the skin-gathering suture to only the inferior portion of the incision, where there may be skin in excess [23].

Evolution of the vertical scar usually is satisfactory. However, the inferior dog-ear and fullness may not resolve and could require later revision. This most often occurs in elderly patients or patients with bad skin elasticity. The small horizontal component may be either premarked or resected initially at the end of the procedure, with a small elliptical resection of skin and subcutaneous layer taking care of the residual dog-ear [62], or it can be corrected at a later stage with the patient under local anesthesia [60]. Even when a horizontal scar has been added primarily, a correction still may be needed on the vertical scar and in the submammary fold in about 5% of cases [5]. As we have shown, a horizontal scar may not be altogether necessary. Limited subdermal undermining at the lower end of the vertical incisions not only may help in cephalad skin gathering where there may be skin in excess, but also will certainly result in better skin retraction without increasing the risk of wound-healing problems. Better skin retraction with very superficial undermining has already been observed with superficial liposculpture, as compared with classical deep liposuction. Liposculpture of the inframammary crease will take care of any residual fullness in this area. Liposuction, by generating skin retraction, has made shorter scars feasible in most cosmetic surgery procedures [30].

Conclusion

Vertical reduction mammoplasty is gradually becoming the preferred method for most plastic surgeons. Difficulties with markings and problems encountered with a long vertical scar and residual dog-ear at the lower end of the vertical scar are detracting many from adopting this technique. Moreover, the downside of any method that requires aesthetic sensitivity is the difficulty in teaching it [20]. Although neophyte plastic surgeons do not lack creativity, they are attracted by well-defined techniques with precise measurements [20]. It may be true that using the same technical constraints of rigid protocols and standardized measurements for patients with

such variations is difficult, particularly when the surgeon's aim is artistic creation [20]. Plastic surgeons, nevertheless, must examine their results critically. Even when patient satisfaction is high, surgeons must continually reassess outcomes to identify problems and devise new solutions [8]. Furthermore, attending surgeons at teaching hospitals have the responsibility to develop simple, clear techniques that can be taught to new generations of surgeons. Any straightforward maneuvers are highly beneficial in the training of young surgeons [8].

We have reevaluated the steps of the vertical reduction mammoplasty. We have applied new modifications and alternative approaches to address the problems of the standard vertical scar technique used with glandular resection and reshaping, but without the glandular liposuction described by Lejour. Several authors have confirmed that the Lejour vertical mammoplasty results in difficulties with management of the skin excess on the vertical scar, always producing marked puckering. This problem cannot always be resolved by a short horizontal scar, as advocated by Marchac [44,45] because it is extremely difficult to predict the outcome at the end of the surgery [5].

The advantages of circumvertical techniques over the standard design in shortening the vertical scar component are obvious. Markings, however, are made easier to grasp and teach by adopting the familiar Wise pattern, which can be adapted easily to the circumvertical design. After transposition of the pattern to the predetermined new nipple location, final circumvertical drawings are made easier and results more reproducible and predictable. We do not believe the use of a "closed" design that does not predetermine the areolar opening would contribute to the ability to establish an aesthetically ideal breast shape intraoperatively or decrease morbidity as claimed [56]. Benelli's round-block suture technique helps to maintain areolar size and prevent spreading and scar stretching because circumareolar scar quality is not compromised by excess tension. Limited subdermal undermining and liposculpture of the inframammary crease help to refine the results and avoid a distressing dog-ear in the early postoperative period that may or may not completely resolve, or a transverse scar in most cases. The simplicity and adaptability of these steps lead to reproducible and reliable results. This permits full realization of the purported advantages associated with vertical mammoplasty, and allows this method to be used with a level of confidence similar to that seen with inverted T techniques. The decision to adopt this method seems well justified [3,23].

References

1. Arié G: Una nueva técnica de mastoplastia. *Rev Lat Am Cir Plast* 3:22, 1957

2. Asplund O, Davies DM: Vertical scar breast reduction with medial flap or glandular transposition of the nipple-areola. *Br J Plast Surg* **49**:507, 1996
3. Beer GM, Spicher I, Cierpka KA, Meyer VE: Benefits and pitfalls of vertical scar breast reduction. *Br Assoc Plast Surgeons* **57**:12, 2004
4. Benelli L: A new periareolar mammoplasty: The "round block" technique. *Aesth Plast Surg* **14**:93, 1990
5. Berthe JV, Massaut J, Greuse M, Coessens B, et al.: The vertical mammoplasty: A reappraisal of the technique and its complications. *Plast Reconstr Surg* **111**:2192, 2003
6. Biesenberger H: Eine neue Methode der Mammoplastik. *Zentralbl Chir* **55**:2382, 1928
7. Brantner JN, Peterson HD: The role of vasoconstrictors in control of blood loss in reduction mammoplasty. *Plast Reconstr Surg* **75**:339, 1985
8. Chen CM, Warren SM, Isik FF: Innovations to the vertical reduction mammoplasty: Making the transition. *Ann Plast Surg* **50**:579, 2003
9. Chen CM, White C, Warren SM, Cole J, Isik FF: Simplifying the vertical reduction mammoplasty. *Plast Reconstr Surg* **113**:162, 2004
10. Chiari Junior A: The L short-scar mammoplasty: A new approach. *Plast Reconstr Surg* **90**:233, 1992
11. Courtiss EH, Goldwyn RM: Reduction mammoplasty by the inferior pedicle technique. *Plast Reconstr Surg* **59**:500, 1977
12. Daane SP, Rockwell WB: Breast reduction techniques and outcomes: A meta-analysis. *Aesth Surg J* **19**:293, 1999
13. Dartigues L: Traitement chirurgical du prolapsus mammaire. *Arch Franco Bel. Chir* **28**:313, 1925
14. Felicio Y: Periareolar reduction mammoplasty. *Plast Reconstr Surg* **88**:789, 1991
15. Finger RE, Vasquez B, Drew GS, Given KS: Superomedial pedicle technique of reduction mammoplasty. *Plast Reconstr Surg* **83**:471, 1989
16. Giovanoli P, Meuli-Simmen C, Meyer VE, Frey M: Which technique for which breast? A prospective study of different techniques of reduction mammoplasty. *Br J Plast Surg* **52**:52, 1999
17. Goes JCS: Periareolar mammoplasty: Double skin technique with application of polyglactin or mixed mesh. *Plast Reconstr Surg* **97**:959, 1996
18. Graf R, de Araujo LRR, Rippel R, Lincoln Grac L, et al.: Reduction mammoplasty and mastopexy using the vertical scar and thoracic wall flap technique. *Aesth Plast Surg* **27**:6, 2003
19. Hagerty RC, Nowicky DJ: Integration of the central mound technique with the vertical skin takeout reduction mammoplasty. *Plast Reconstr Surg* **102**:1182, 1998
20. Hall-Findlay EJ: A simplified vertical reduction mammoplasty: Shortening the learning curve. *Plast Reconstr Surg* **104**:748, 1999
21. Hammond DC: Short scar periareolar inferior pedicle reduction (SPAIR) mammoplasty. *Plast Reconstr Surg* **103**:890, 1999
22. Hester TR, Bostwick J, Miller L, Cunningham SJ: Breast reduction utilizing the maximally vascularized central breast pedicle. *Plast Reconstr Surg* **76**:890, 1985
23. Hidalgo DA: Vertical mammoplasty. *Plast Reconstr Surg* **115**:1179, 2005
24. Hidalgo DA, Elliot LF, Palumbo S, Casas L, Hammond D: Current trends in breast reduction. *Plast Reconstr Surg* **104**:806, 1999
25. Hoffman S: Reduction mammoplasty: A medicolegal hazard? *Aesth Plast Surg* **11**:113, 1987
26. Hollyman JA, Lacey JH, Whitfield PJ, Wilson JSP: Surgery for the psyche: A longitudinal study of women undergoing reduction mammoplasty. *Br J Plast Surg* **39**:222, 1986
27. Hughes LA, Mahoney JL: Patient satisfaction with reduction mammoplasty: An early survey. *Aesth Plast Surg* **17**:345, 1993
28. Hugo NE, McClellan RM: Reduction mammoplasty with a single superiorly based pedicle. *Plast Reconstr Surg* **63**:230, 1979
29. Iqbal A, Ellabban MG: Vertical scar reduction mammoplasty refinements. *Plast Reconstr Surg* **115**:977, 2005
30. Karcenty B, Flageul G: Liposuction and liposculpture. *Ann Chir Plast Esthet* **48**:399, 2003
31. Kerrigan CL, Collins ED, Striplin D, et al.: The health burden of breast hypertrophy. *Plast Reconstr Surg* **108**:1591, 2001
32. Klaus E, Oliver: Dermal Suspension Flap in Vertical-Scar Reduction Mammoplasty. *Plast Reconstr. Surg* **109**:2289, 2002
33. Knipper P: Vertical mammoplasty with a clamp technique. *Ann Plast Surg* **48**:622, 2002
34. Kreithen J, Caffee H, Rosenberg J, Chin G, et al.: A comparison of the LeJour and Wise pattern methods of breast reduction. *Ann Plast Surg* **54**:236, 2005
35. Lalonde DH, Janice Lalonde J, French R: The no-vertical-scar breast reduction: A minor variation that allows you to remove vertical scar portion of the inferior pedicle Wise pattern T scar. *Aesth Plast Surg* **27**:335, 2003
36. Lassus C: A technique for breast reduction. *Int Surg* **53**:69, 1970
37. Lassus C: A 30-year experience with vertical mammoplasty. *Plast Reconstr Surg* **97**:373, 1996
38. Lee CJ, Kim YJ, Seo YT, Pak SJ, et al.: Treatment of multiple bilateral juvenile fibroadenomas in a teenage breast by central pedicle breast reduction, with vertical and short horizontal scar: Case report. *Aesth Plast Surg* **28**:228, 2004
39. Lejour M: Vertical mammoplasty. *Plast Reconstr Surg* **92**:985, 1993
40. Lejour M: *Vertical mammoplasty and liposuction* Quality Medical Publishing Inc, St Louis, 1994
41. Lejour M: Vertical mammoplasty and liposuction of the breast. *Plast Reconstr Surg* **94**:100, 1994
42. Lötsch F: Über Hängebrustplastik. *Zentralbl Chir* **50**:1241, 1923
43. Mandrekas AD, Zambacos GJ, Anastasopoulos A, Hapsas DA: Reduction mammoplasty with the inferior pedicle technique: Early and late complications in 371 patients. *Br J Plast Surg* **49**:442, 1996
44. Marchac D, de Olarte G: Reduction mammoplasty and correction of ptosis with a short inframammary scar. *Plast Reconstr Surg* **69**:45, 1982
45. Marchac DA: Vertical mammoplasty with a short horizontal scar, ed. In: Spear S L *Surgery of the breast: Principles and art*. Lippincott-Raven, Philadelphia, p 749, 1998
46. Mathes SJ, Nahai F, Hester TR: Avoiding the flat breast in reduction mammoplasty. *Plast Reconstr Surg* **66**:63, 1980
47. McCulley SJ, Rousseau TA: A modified Chiari L short-scar mammoplasty: The technique and results. *Br J Plastic Surg* **52**:112, 1999

48. McKissock PK: Reduction mammoplasty with a vertical dermal flap. *Plast Reconstr Surg* **49**:245, 1972
49. Menke H, Eisenmann-Klein M, Olbrisch RR, Exner K: Continuous quality management of breast hypertrophy by the German Association of Plastic Surgeons: A preliminary report. *Ann Plast Surg* **46**:594, 2001
50. Menke H, Restel B, Olbrisch RR: Vertical scar reduction mammoplasty as a standard procedure: Experiences in the introduction and validation of a modified reduction technique. *Eur J Plast Surg* **22**:74, 1999
51. Mitz V: *Manuel de chirurgie plastique et esthétique du sein*. Frison Roche, Paris, 1995
52. Mottura A: Circumvertical reduction mammoplasty: New considerations. *Aesth Plast Surg* **27**:85, 2003
53. Nahai F: Vertical reduction. *Op Tech Plast Reconstr Surg* **6**:97, 1999
54. Ofodile FA, Bendre D, Norris JE: Cosmetic and reconstructive breast surgery in blacks. *Plast Reconstr Surg* **76**:708, 1985
55. Pallua N, Ermisch C: "I" Becomes "L": Modification of vertical mammoplasty. *Plast Reconstr Surg* **111**:1860, 2003
56. Palumbo S, Shifren J, Rhee C: Modification of the Lejour vertical mammoplasty: Analysis of results in 100 consecutive patients. *Ann Plast Surg* **40**:354, 1998
57. Passot R: La correction du prolapsus mammaire par le procédé de la transposition du mamelon. *Presse Medicale* **33**:19, 1925
58. Pickford MA, Boorman JG: Early experience with the Lejour vertical scar reduction mammoplasty technique. *Br J Plast Surg* **46**:516, 1993
59. Pitanguy I: Surgical correction of breast hypertrophy. *Br J Plast Surg* **20**:78, 1967
60. Poëll JG: Vertical reduction mammoplasty. *Aesth Plast Surg* **28**:59, 2004
61. Qi FZ, Gu JY, Zhang XJ, Yang Z, et al.: Vertical reduction mammoplasty [in Chinese]. *Zhonghua Zheng Xing Wai Ke Za Zhi* **20**:325, 2004
62. Ramirez OM: Reduction mammoplasty with the "owl" incision and no undermining. *Plast Reconstr Surg* **109**:512, 2002
63. Robbins TH: A reduction mammoplasty with the areola-nipple based on an inferior dermal pedicle. *Plast Reconstr Surg* **59**:64, 1977
64. Skoog T: A technique of breast reduction—transposition of the nipple on a cutaneous vascular pedicle. *Acta Chir Scand* **126**:453, 1963
65. Spear SL, Howard MA: Evolution of the vertical reduction mammoplasty. *Plast Reconstr Surg* **112**:855, 2003
66. Strömbeck JO: Mammoplasty: Report of a new technique based on the two-pedicle procedure. *Br J Plast Surg* **13**:79, 1960
67. Tien-Hsing C, Fu-Chan W: Evolution of the vertical reduction mammoplasty: The S approach. *Aesth Plast Surg* **21**:97, 1997
68. Wise RJ: A preliminary report on a method of planning the mammoplasty. *Plast Reconstr Surg* **17**:367, 1956
69. Yousif NJ, Larson DL: The apron technique of reduction mammoplasty: Elimination of the vertical scar. *Perspect Plast Surg* **8**:137, 1994