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Breast Deformity Caused by Anatomical or Teardrop Implant Rotation

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Anatomical or "teardrop" breast implants have an asymmetrical profile when the nonimplanted prosthesis is viewed resting on a horizontal surface. Anatomical breast implants have recently experienced increased popularity with plastic surgeons. They currently exist both in saline and silicone gel forms and are distributed in the United States through three different manufacturers: Mentor (Santa Barbara, Calif.), McGhan (Santa Barbara, Calif.), and Silimed (Garland, Texas). These implants are marketed under various model names, including: Anatomical, Biodimensional, Contour, Contour Natural, Natural, Oval, and others. Although the first major manufacturer to produce this type of implant was Dow Corning in 1962[1] (using the original design of Drs. Cronin and Gerow[2]), it was not until the renaissance of saline implants in the 1990s that the idea of introducing an anatomical implant was reborn. It was hoped that this style of implant would provide the surgeon with a device capable of producing a more natural breast shape, especially in this era of the Food and Drug Administration moratorium when silicone gel implants are not uniformly available for the primary breast augmentation patient. As a secondary benefit, some speculated that the gravitational forces that dictate fluids conform to a teardrop shape would naturally cause less deformation (i.e., fewer wrinkles) of the upright anatomical implant than to the upright round implant because the former is already molded into a teardrop shape.[3,4] This same idea was further promoted by verbal communication from manufacturer's representatives.[5]

In 1999, this investigator reported to one breast implant manufacturer what was felt to be an isolated case of an acute onset of a unilateral breast deformity in a woman 9 weeks after uneventful elective augmentation mammaplasty (Fig. 1). Soon after, a second similar case with similar findings presented (Fig. 2). A brief communication[6–9] preliminarily reporting this potential problem prompted 31 plastic surgeons to offer descriptions of patients with similar concerns.

Impromptu discussions with more senior surgeons revealed that most avoided use of the current generation of anatomical implants because of personal unfavorable experiences gleaned from use of similarly shaped devices in the 1960s, 1970s, and 1980s. It seems that awareness of the tendency of these implants to become rotated or malpositioned was virtually universal among those practicing breast surgery 20 years ago. What was perplexing to this author was discovering a dearth of published knowledge regarding this phenomenon.

Two recent multicenter retrospective reviews, reporting on the safety of saline implants, seem to lack inquiry regarding implant (especially anatomical) rotation.[10,11] To assist in a better understanding of this problem, a retrospective review of this author's experience with this type of implant was felt warranted. For the purpose of this report, the terms malposition, misplaced, rotation, and spun are used synonymously to mean implant misorientation, and do not refer to implant displacement associated with pocket overdissection.

Case Report

A 37-year-old woman (Fig. 1, *above, left*) underwent uneventful retromammary augmentation mammaplasty using Mentor style 2900 implants. Routine follow-up examination

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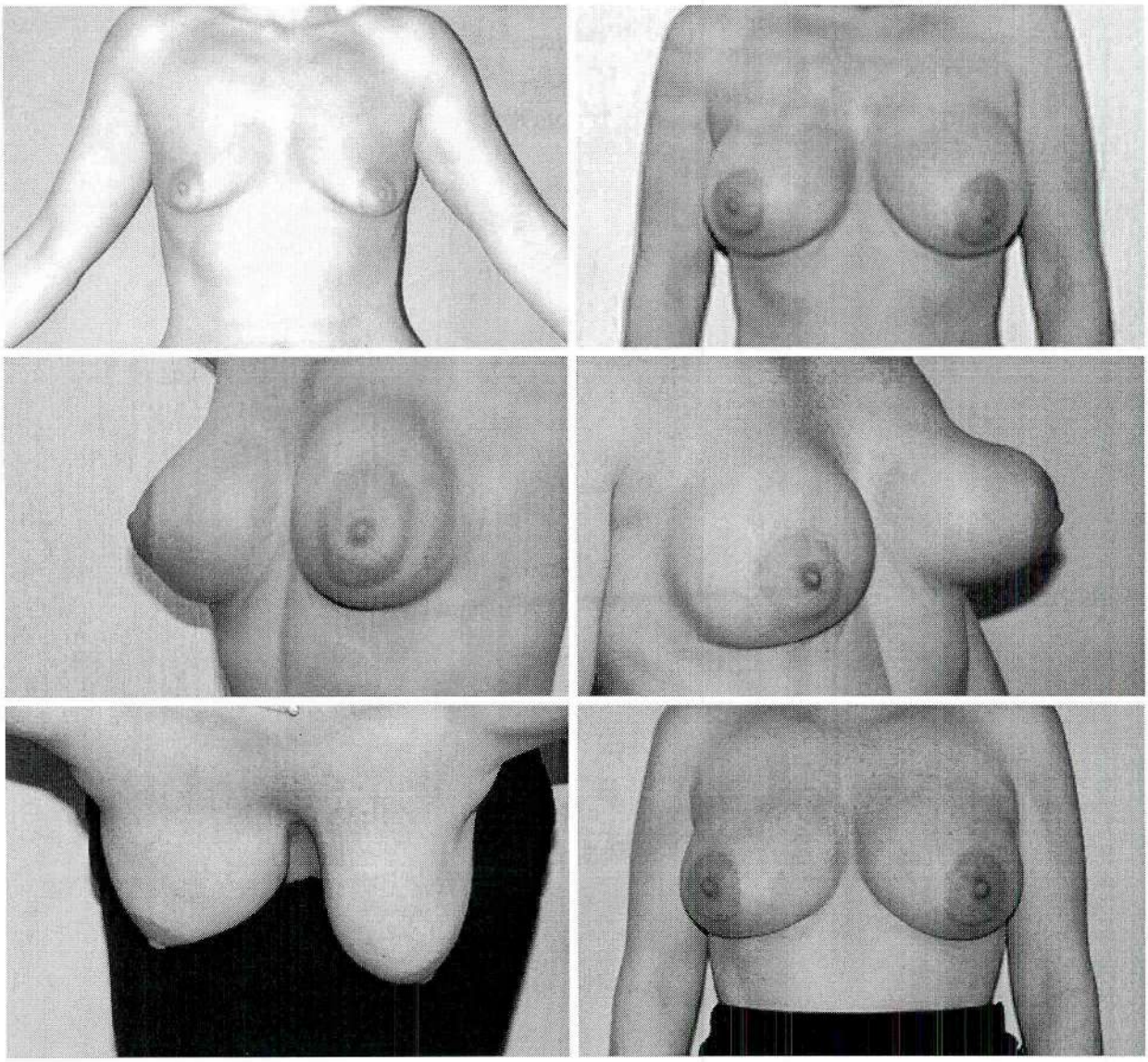

FIG. 1. Patient 1. (*Above, left*) Preoperative symmetry in a 37-year-old woman. (*Above, right*) Still symmetrical at 8 weeks postoperatively. (*Center, left*) Left implant turned on *y* axis at 9 weeks, and painful. (*Center, right*) Left implant flipped on *x* axis. (*Below, left*) Bird's-eye view demonstrating torpedo-like projection of left implant. (*Below, right*) Symmetry restored after implant exchange.

at days 1 and 3, and weeks 1, 4, and 8, found no indication of problems (Fig. 1, *above, right*). The patient then returned 9 weeks after surgery demonstrating acute onset of dynamic breast deformity and mastodynia. The patient could easily demonstrate mobility of the implants in the *x*, *y*, and *z* axes with self-manipulation (Fig. 1, *center, left*; *center, right*; and *below, left*). Both breasts were type I according to Baker's classification.[12] At reoperation for implant exchange, both implants were confirmed to have completely "spun" on their *z* axes.

PATIENTS AND METHODS

From February of 1995 to October of 1999, anatomical implants were made available by the author to all patients desiring augmentation mammaplasty, and were especially recommended to those whose hypoplastic breasts lacked much natural shape. Along with patient's desires for cup size, standard topographical breast/thoracic measurements (i.e., breast base width, height, thoracic circumference and SN-N, N-N, and N-IMF distances) all were used to assist with proper implant choice. When anatomical implants were chosen, they were always textured. Sizers were used to assist with implant selection. Mammaplasty was per-

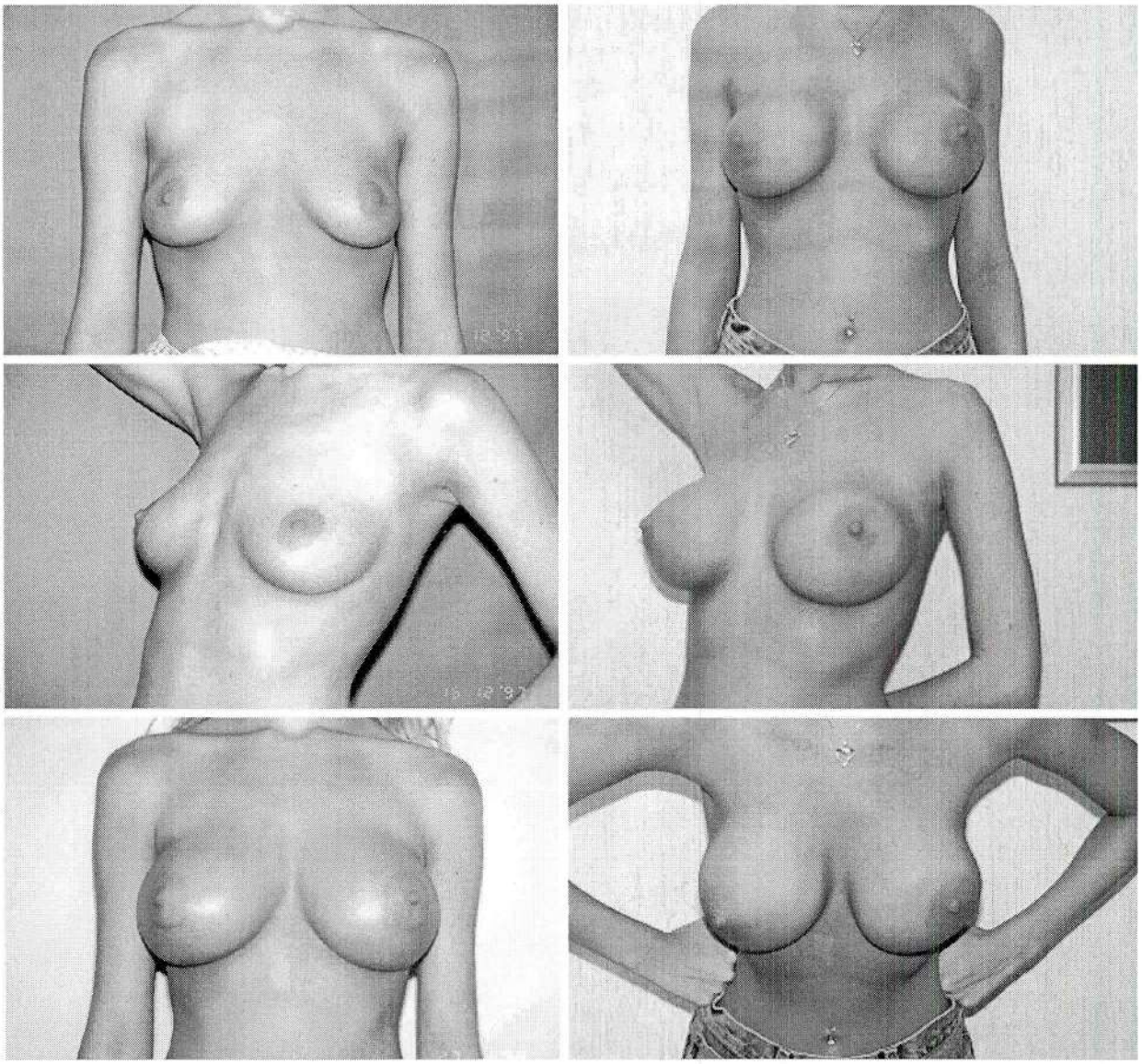

FIG. 2. Patient 2. (*Above, left,* and *center, left*) A 19-year-old with symmetrical breasts. (*Below, left*) Normal symmetry with retromammary Mentor style 2700 implants at 7 weeks. (*Above, right* and *center, right*) At 26 months, left implant has flipped and spun, with anterior implant surface against chest wall. (*Below, right*) Bird's-eye view demonstrates abnormal contour of left breast with malposition and flattening of nipple-areola complex.

formed in the outpatient setting under monitored anesthesia. The preferred incision was periareolar. Implants were placed in the retropectoral or retromammary position. The technique used by the author for performing augmentation mammaplasty, and pocket creation in particular, was consistent with that well documented in the surgical literature.[13–21] Close adherence to these principles was followed. The postsurgical protocol involved wearing a nonwired compression bra and a bandeau for 1 to 2 weeks (increased to 1 month in January of 1999). Most patients were seen for routine postoperative follow-up at 1, 3, and 8 days; at 1 and 2 months; and as needed.

Retrospective review of all anatomical or "teardrop" breast implant cases performed by this author was undertaken. In addition, each patient was contacted by means of survey. All were given the opportunity to return for physician examination. Analysis was made of the total number of anatomical implant patients, total number of implants, procedure type, number of patients with obvious implant mal-

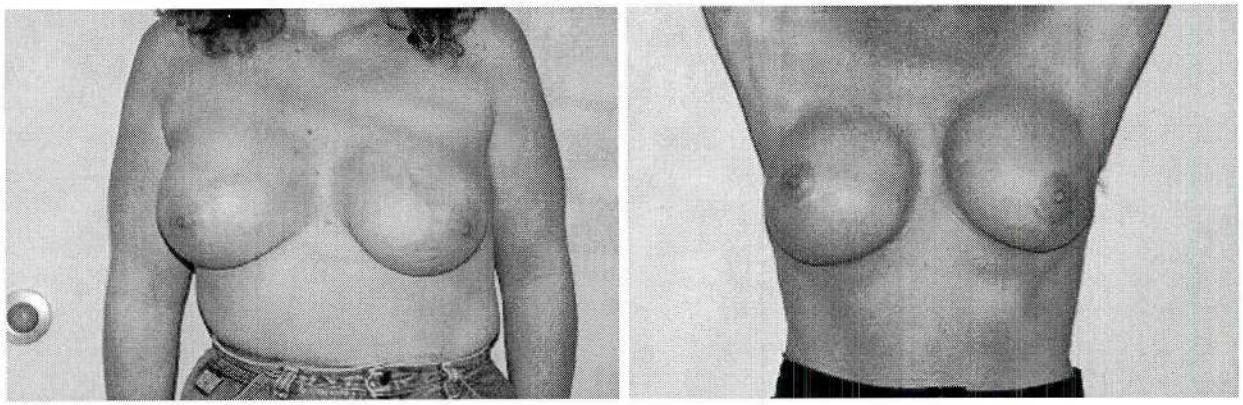

FIG. 3. Patients 3 and 4. (*Left*) Asymmetry in a 35-year-old 10 months after retromammary augmentation with Mentor style 2900 implants. Both implants have spun. Left implant has also flipped. Note asymmetry of upper poles and nipple-areola complex. (*Right*) Loss of lower pole fullness and abnormal medial and upper fullness in left breast of 37-year-old with spun left retromammary Mentor style 2900 implant 9 months postoperatively.

position, and number with suspected implant malposition. Implant manufacturer, style number, fill volumes, pocket position, associated mastodynia, capsule contracture, and occurrence of postsurgical complications were recorded. A photographic record was made. As a result of the author's published brief communications,[6–9] multiple case reports were received from other plastic surgeons. However, for statistical purposes, only patients initially operated on by the author were included in this study. Statistical analysis for these nominal data were performed using the chi-square and nonparametric tests.

RESULTS

Between February of 1995 and October of 1999, 317 anatomical saline breast implants were implanted in 156 women and three transsexuals. Of these 159 patients, 58 received Mentor style 2700 Contour Profile implants (n = 118), 100 received Mentor style 2900 Contour Profile Natural implants (n = 197), and one received McGhan style 163 Biodimensional implants (n = 2). Of the total, 119 patients received implants in the retromammary pocket, whereas 40 patients' implants were retropectoral. Procedures performed included elective augmentation mammaplasty (n = 158) and postmastectomy reconstruction (n = 1). Seven of these patients returned for secondary implant mammaplasty/implant exchange. In the study group, implants were overfilled by an average of 40 cc above the manufacturer's recommended minimum volume (range, 0 to 100 cc).

Follow-up with all patients involved mail-in survey, telephone interview, e-mail communication, and/or office examination. Seventy-five percent of women (n = 119) expressed complete satisfaction with the shape of their breasts through survey or interview, or had no complaints and chose to defer follow-up examination. Twenty-two women indicated dissatisfaction with the shape (not size) of either or both breasts.

Findings

In a patient with anatomical implants, the nipple-areola complex is often the telltale sign of implant malposition (Fig. 3). With the implant's fuller lower pole spun 90 degrees medialward on the z axis, the nipple-areola complex is typically shifted or pointing lateralward. With the implant completely spun 180 degrees on the z axis (i.e., the 6 o'clock tab residing at 12 o'clock), the breast appears as though it has a type II breast base anomaly[22] with the nipple-areola complex pointing downward. Implants spun with the 6 o'clock tab positioned lateralward often present with abnormally wide cleavage and the nipple-areola complex pointing medialward. Implants that have flipped 90 degrees on the x axis will rarely stay in that position, but will demonstrate a bizarre total loss of the upper pole fullness and extreme torpedo-like projection (Fig. 1, *center, right*). Similarly, implants that have turned 90 degrees on the y axis will demonstrate abnormal loss of lateral fullness (Fig. 1, *center, left*).

Implants were identified by patient or physician as having first become malpositioned between 3 and 38 months after surgery, although exact dating was impossible in many. Increasing use of the postsurgical bandeau from 2

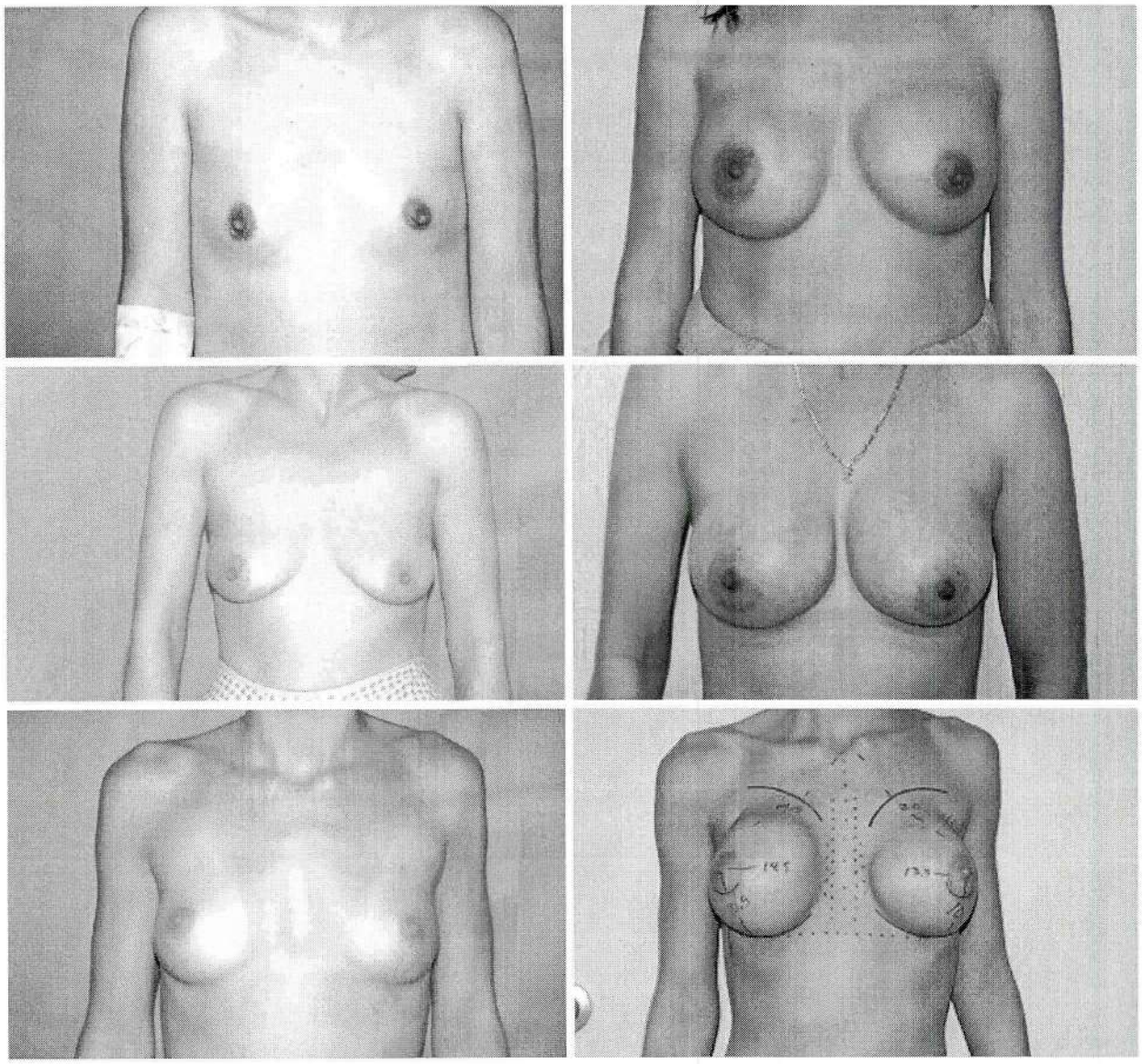

FIG. 4. Patients 5, 6, and 7. (*Above*) A 23-year-old with spun left retropectoral Mentor style 2900 implant, 10 months postoperatively. Note deficient left lower inner quadrant. (*Center*) A 36-year-old with retromammary placement of Mentor style 2900 implants 12 months previously, with asymmetry of upper poles and mastodynia. The patient can the change the shape of her breasts. (*Below*) A 21-year-old with Mentor style 2900 implants. Postoperative hematoma on left (day 2), unrelated to later rotation of right implant. Note asymmetry of nipple-areola complex.

weeks to 1 month did not prevent implant malposition.

Dynamic Implant Malposition

A subset of 11 women (17 implants) could clinically demonstrate to the physician how manual manipulation of their soft breasts could cause unnatural if not bizarre geometric shapes of their breasts. Despite texturing, their implants were obviously freely moveable (i.e., a dynamic process). Inexplicably, in many, this was associated with mastodynia, relieved only when the implants were returned to their orthotopic position. In some, deformed soft breasts were returned to their natural shape only after the author bimanually manipulated the implants. This would rarely provide lasting results.

Women with dynamic implant malposition ($n = 11$) could often relate an inciting event that they felt caused their implants to move. This ranged from massage by a patient's husband, to self-manipulation by a dancer, to pectoral isometric exercise by an aerobic instruc-

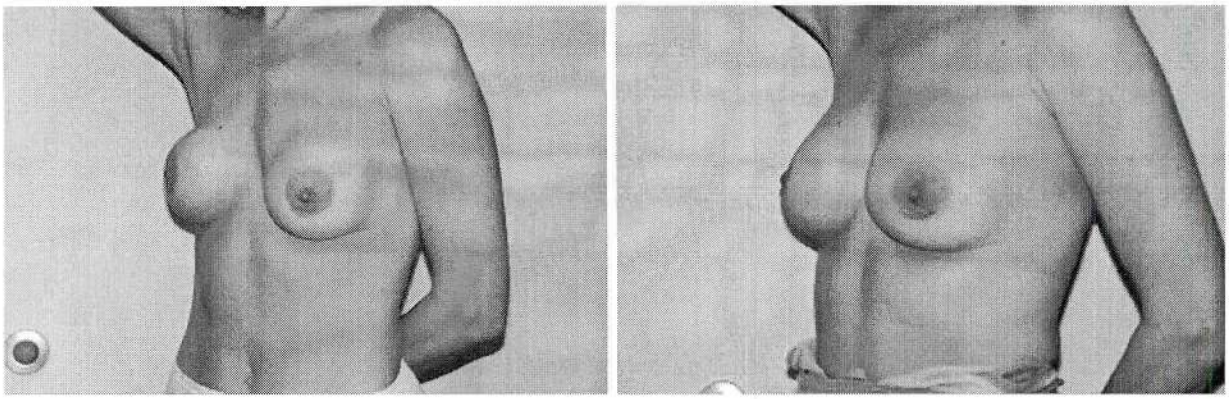

FIG. 5. Patient 8. (*Left*) A 37-year-old with Baker's type IV contractures. Smooth anatomical Dow Corning implants placed 11 years previously. No suspicion of implant malposition. Both implants incidentally discovered to have spun and flipped. (*Right*) Result after capsulorrhaphy and implant exchange.

tor, to routine mammography, to blunt trauma to the chest of an actress falling off stage. Many reported the sensation of Velcro ripping, often with momentary associated pain. However, the more common history of initial awareness of a deformed breast was during routine self-breast examination. If an inciting event precipitated the malposition, it was often so trivial as to be overlooked.

Reoperation was performed on six of the 11 women (10 implants) with dynamic malposition. Diagnosis of dynamic anatomic implant malposition was confirmed intraoperatively in all six patients.

Suspected or Static Implant Malposition

A larger number of women ($n = 16$) with anatomical implants and soft breasts (Baker's classification type I/II) presented with mildly or markedly obvious shape deformity out of proportion to any prior postsurgical asymmetry (Fig. 4). These women indicated prior satisfaction with the feminine appearance of their breasts, only later to notice a (typically unilateral) breast deformity. In some, the breast deformity was subtle, detected only by the author. All patients in this group were unable to give a history of any dynamic nature to the deformity, nor were they able to demonstrate to the author the ability to manually change their breast shape. Furthermore, the author was unable to improve breast shape with any type of bimanual compressive technique. These women could only be suspected of having a fixed or static deformity because confirmation of this diagnosis requires reoperation.

Of sixteen women who had static (suspected) implant malposition, four women (five implants) underwent reoperation. All were confirmed to have malpositioned implants (three unilateral and one bilateral).

Capsule Contracture

Published 1- and 3-year patient risk of capsule contracture is 4.6 percent and 9.0 percent, respectively. In this study, 5 women (3.1 percent) presented with firm breasts (Baker's classification type III/IV). Two had no asymmetry. Although asymmetry might lead one to query concurrent implant malposition, in these women diagnosis again could only be confirmed at reoperation. Four women (eight implants) underwent reoperation for severe capsule contracture. All were identified as having malpositioned implants! To analyze this small set of data, a chi-square test corrected for continuity was used. The result was chi-square = 6.31 with 1 *df*. The probability level is $p < 0.025$. Capsule contracture increases the risk of implant malposition.

Incidental Implant Malposition

An additional subgroup of three women (six implants) underwent secondary implant ex-

TABLE I

Implant Placement As Related to Rotation

Rotation/ Placement		Retro-mammary	Retro-pectoral	Total Implants
Yes	Observed	24	12	36
	(expected)	(26.9)	(9.1)	
No	Observed	213	68	281
	(expected)	(210.1)	(70.9)	
	Total	237	80	317

Chi-square with 1 *df* = 1.396. This falls within the 0.25 and 0.10 probability ranges. This does not support a hypothesis of a relationship between implant placement and rotation.

TABLE II
Implant Malposition As Related to Hematoma

Hematoma/Rotation		Yes	No	Total Implants
Yes	Observed	4	1	5
	(expected)	(0.56)	(4.41)	
No	Observed	32	280	312
	(expected)	(35.4)	(276.6)	
	Total	36	281	317

Using the formula for 2 × 2 contingency tables from Siegel's *Non-parametric Statistics*, the resulting chi-square with 1 df = 17.355. The probability level associated with a chi-square this large is smaller than 0.005. The hypothesis that no relationship exists between malposition and hematoma is rejected.

change by this author during (1) capsulorrhaphy for severe capsule contracture (two patients) or (2) mastopexy for postoperative ptosis (one patient). Primary augmentation with anatomical implants had been performed by surgeons other than the author (2, 4 and 11 years previously) and were therefore excluded from statistical analysis. These six implants (two Mentor style 2900, two McGhan style 163, and two Dow Corning of unknown style) were all incidentally found to be malpositioned (Fig. 5). The presence of capsule contracture or large breast size completely precluded any preoperative suspicion of implant malposition in these women.

For statistical purposes, implants were determined to be malpositioned if (1) dynamic implant malposition was documented and/or (2) a minimum of 45 degrees of displacement in one of three rotational axes (x, y, or z) was documented at reoperation. In the latter group, signed affidavits attesting to these findings were obtained from the scrub nurses.

Treatment

Three patients with dynamic implant malposition gave special surgical consent to attempt anchoring their malpositioned implants onto the chest wall by suturing the posterior 6 o'clock positioning tab to the fascia. Eventually, the Silastic tab tore in at least two of the three patients.

Successful treatment of malpositioned implants involves anatomical-to-round implant exchange or, at the woman's request, implant removal. The American Society of Plastic Surgeons guidelines for implant removal[23] include significant implant malposition. Reoperation on 17 women (29 implants) with implant malposition was performed. No reoperation was performed less than 6 months after initial mammaplasty. Preoperative and intraoperative measurements confirmed no inaccuracies with

TABLE III
Implant Styles As Related to Malrotation

		Style		
		2900	2700	Total
Malrotation				
Yes	Count	24	12	36
	Expected Count	22.5	13.5	–
No	Count	173	106	279
	Expected Count	174.5	104.5	–
Total	Count	197	118	315

initial pocket design. Only minimal serous fluid was encountered in the reopened implant pockets. Tissue ingrowth was nonexistent with the single pair of Dow Corning smooth implants; little better in all 30 textured Mentor (Siltex) implants; but substantial with the two pairs of McGhan textured (Biocell) implants. Diagnosis of implant malposition was confirmed intraoperatively in all 17 patients. No correlation between style number and malposition was identified. Follow-up (range, 14 to 25 months) has identified no further complaints regarding breast shape.

Risk Rate

Of the total 159 women in the study group, 22 had confirmed rotation of their anatomical implants. The risk rate of this complication is at least 14 percent. Of those with suspected malrotation, only those later definitively diagnosed at the time of reoperation were included in this group. Noting the near ubiquity of suspected implant malposition with definitive surgical diagnosis, the risk rate is undoubtedly even higher.

Implant Position

No statistically significant relationship exists between retropectoral and retromammary implant placement and malposition (Table I).

Implant Fill Volumes

The distributions of implant fill volumes for malpositioned implants and nonrotated implants were analyzed to determine the significance of the difference between the means of implant volume for the two sets of data. A t test was used for this analysis. Table II exhibits the results of this test. The mean of those with malpositioned implants was 389 cc and the mean of those with nonrotated implants was 391 cc. Thus, there is no statistically significant difference between the mean sizes of implants

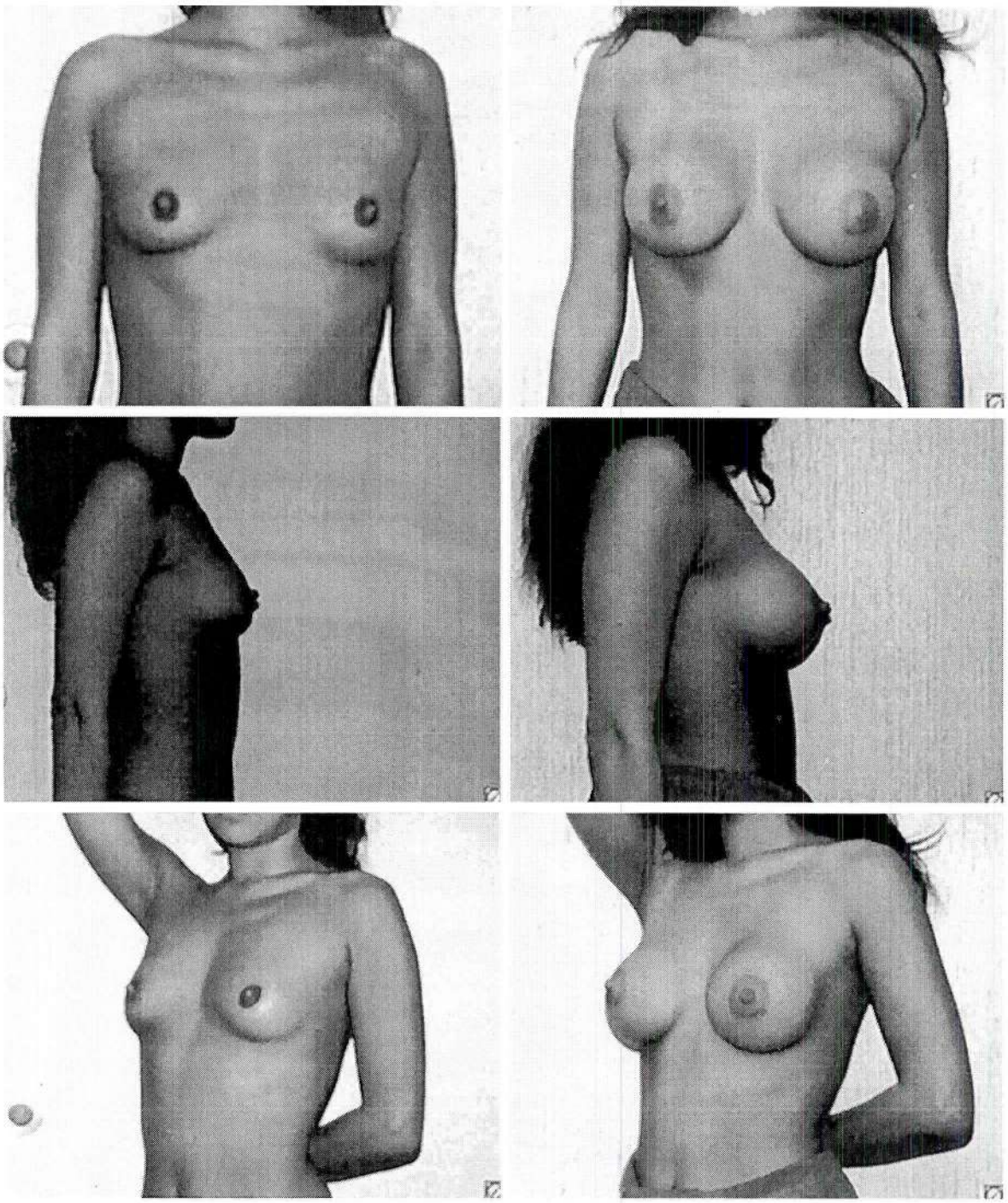

FIG. 6. Patient 9. A 22-year-old preoperatively (*left*) and 2 months after augmentation with Hutchison style HSH-0200 *round* implants (*right*).

that became malpositioned and implants that were normally oriented.

Implant Styles

No statistically significant relationship was found to exist between the style of implant (Mentor styles 2700 and 2900) and development of malposition. Chi-square was calculated using a 2×2 contingency procedure. The chi-square value was 0.295 with 1 *df*. The probability level for this chi-square, with 1 *df*, is $p < 0.50$. Table III demonstrates this analysis.

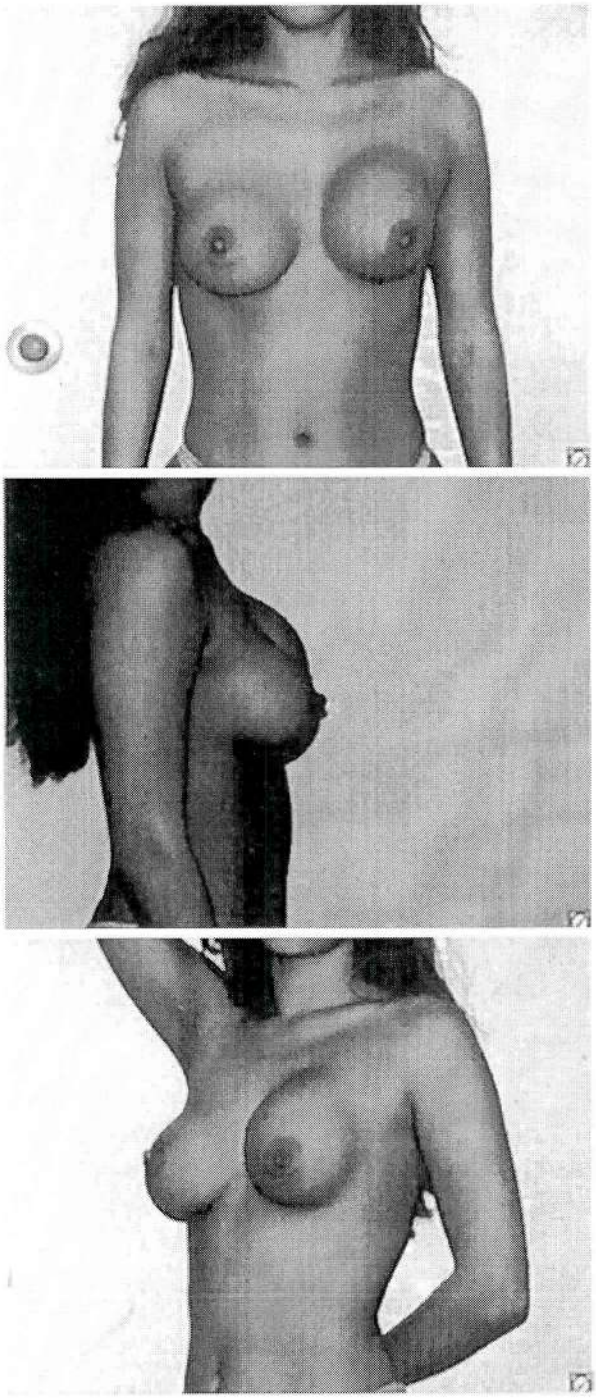

FIG. 7. Patient 9. Before reoperation for left Baker's type III breast contracture. Left round implant incidentally found to have turned on its *y* axis.

Bilaterality

Of the study group, 22 patients had implant malposition. Of these 22 patients, 14 (64 percent) had bilateral rotation. Eight of the 22 (36 percent) had unilateral rotation. Thus, if a patient is diagnosed as having implant malposition, there may be a greater chance of this being a bilateral phenomenon. A chi-square goodness-of-fit test yields chi-square = 1.64 with 1 *df*, which gives a probability level of $p < 0.22$.

Complications

Five hematomas occurred in the study group (3.14 percent). This rate is not significantly different from that reported[11,24] (95 percent confidence interval, 0.004 to 0.058). All five were evacuated (Table II). No other complications were identified.

DISCUSSION

Demand for breast implants continues to grow rapidly. The American Society of Plastic Surgeons reported a 476 percent increase in breast augmentation procedures between 1992 and 2000.[25] For 2000, 201,310 breast augmentations were estimated to have been performed.[26] It is uncertain what proportion was performed using anatomical breast implants. It is estimated that in 1998 alone, 50,000 pairs of anatomical implants were sold by the three American breast implant distributors.[1] These implants were designed to provide the plastic surgeon with a valuable tool in breast augmentation and reconstruction. Some reports suggest anatomic implants may have minimal to no advantage over round implants.[1,3,27–30]

This study investigates possible risks unique with anatomic breast implants. Anatomical breast implants can become malpositioned into any of a number of bizarre geometric shapes. They can move in any of three dimensions. In other words, a malpositioned teardrop implant can "flip like a pancake" (*x* axis), "turn like a barn door" (*y* axis), or "spin like a pinwheel" (*z* axis). This phenomenon likely occurs in part because of the asymmetrical design of the anatomical or teardrop implant. It can create extreme emotional anxiety and complaints of mastodynia in some, yet in others be unnoticeable to patient and physician alike. Niechajev,[31] in describing the experience of his three-surgeon group in Switzerland, reported that their 450-patient series demonstrated anatomical implant rotations in "about 5% primary and more than 10% secondary cases."

Manufacturer's data as recently presented before the Food and Drug Administration[32] and distributed to the public[33] are difficult to

interpret, as clinical studies seem to have blended statistics for both round and anatomical style implants. Realizing that these published risk rates are diluted down by inclusion of the larger proportion of round implant data, an amazingly high 7 percent rate of asymmetry is still reported. The etiology of this asymmetry is left for the speculation of the reader. Furthermore, this same publication reports that 8 percent of reoperation procedures 3 years after augmentation are performed to "reposition implant" and 16 percent of augmentation patients having implants removed do so for "asymmetry/wrinkling/sagging/scarring" (again, data blend round and anatomical implants). Also, it is noteworthy that patients in these studies with multiple complaints/findings were only allowed to have a single reason recorded. Therefore, the incidence of this problem as it pertains to anatomical implants is again likely underreported.

In this study, the risk rate for anatomical implants becoming malpositioned is *at least* 14 percent. Implant malposition can be static or dynamic. Definitive diagnosis can only be made (1) when the breast implant can be demonstrated by manipulation (usually by the patient) to change position and therefore breast shape (i.e., dynamic implant malposition) or (2) when the breast implant is discovered intraoperatively to have rotated. To date, no radiological study can reliably diagnose anatomical implant malposition (author's ongoing research). A diagnosis of suspected anatomical implant malposition can often be made on the basis of an otherwise inexplicable deformity in the soft breast, especially if it is unilateral. These women will have had symmetrical, natural-appearing breasts during the earlier postsurgical period.

In women with Baker's classification type III/IV contracted breasts, it is impossible to positively differentiate between deformity caused by a pure capsule contracture versus a capsule contracture with concurrent implant malposition. However, in this study, all patients operated on with severe capsule contracture had malposition of both anatomical implants! *The apparent ability of scar contracture forces not just to deform implants but to cause implant malposition cannot be overstated.*

Much attention is devoted in the literature to stressing the importance of proper implant selection and pocket design. It would be incorrect to assume that the malposition problem described by this author is merely a reflection of selecting too small an implant or creating too large of a pocket. Even the (theoretically) perfectly conforming implant/soft-tissue pocket interface could not ensure against implant malposition. The rationale for this is that there will be no fibroblastic ingrowth anchoring the textured implant during the immediate postsurgical period, plus a minimal amount of lubricating serous fluid is likely. How then is the snugly fitting implant any more protected from freely spinning than the ball bearing? In a ball bearing, one has an even tighter fitting implant (the steel ball) surrounded by a more snugly fitting pocket (the steel raceway), separated only by the thinnest amount of serous-like lubricating fluid. Because diligent care was taken by the author to follow all accepted techniques in creation of the mammaplasty pocket, hemostasis, and implant selection, it is certain malposition of the implant is unlikely a function of technique. What is more likely responsible for implant malposition is the following: (1) pocket shape is a dynamic three-dimensional process, often influenced as much by capsule contracture and skin tightness as the surgeon's technique and furthermore cannot be controlled postoperatively by the surgeon; (2) many textured implants experience no anchoring fibroblastic ingrowth or collagen deposition; (3) a biofilm or meniscus likely surrounds breast implants, further discouraging fibroblastic ingrowth,[34] and possibly acting as a lubricant; (4) implants are highly amorphous, unable to maintain much inherent shape when confronted with even minor surrounding deforming forces, let alone the highly deforming forces of severe capsule contracture[35]; and (5) the forces exerted on a retromuscular implant by the pectoralis major (even more so if the muscle is partially released) are directed in a horizontal and oblique vector (i.e., clavicle and midsternal origin to humeral greater tubercle insertion). The vector of these forces is contrary to the 6- to -12 o'clock axial orientation of the vertical or tall anatomical implant (Mentor styles 1500, 1700T, 5000, and 6000; McGhan styles 153, 163, 410 M, and 468; and Silimed style 20581) and contrary to the 3- to -9o'clock axial orientation of the horizontal or wide anatomical implant (Mentor styles 2500, 2700, and 2900; and McGhan styles 363 and 410L). The incredible deforming forces generated by the flexed pectoralis are well documented.[36] With continual body movement, es-

pecially when the implant is retropectoral, constant massage or "milking" of the implant will tend to reorient it, thus leading to malposition and breast distortion. Smooth implants (e.g., Mentor Oval styles 1500 and 1700T) would logically seem to be at even greater risk for malposition than textured implants. This leads one to ponder whether a more enigmatic problem might likewise exist within round implant mammaplasty patients (Figs. 6 and 7).

The occurrence of hematoma formation in this author's series was coincident with published reports.[11,24] Hematoma formation increased the risk of implant malposition from 23 percent to 80 percent. Although most do not advocate routine placement of drains with mammaplasty, possibly (at least when using anatomical implants) this idea deserves reconsideration.

Teardrop implant malposition is apparently unrelated to fill volume, pocket location, or length of bandeau usage. The likelihood of Mentor style 2700 implants becoming malpositioned was statistically similar to Mentor style 2900. This author's preferential use of that of Mentor anatomical implants makes definitive conclusions regarding the tendency of McGhan Biodimensional and Silimed anatomical implants impossible. However, it is curious that both McGhan patients (author's bilateral mastectomy reconstruction patient and secondary mammaplasty/implant exchange patient from another surgeon) had bilateral malpositioned vertical anatomical implants.

The moderate tendency for bilaterality seems logical, considering the similarity in mechanical and biological forces experienced by the right and left sides of the chest.

Although the median age range of women undergoing augmentation mammaplasty is 19 to 34 years,[25] as these patients age, they will undergo frequent routine mammography. This necessary procedure creates highly deforming forces (up to 40 lb per square inch) on the breasts. The potential for more women developing this problem therefore only increases with patient age.

National marketing campaigns by implant manufacturers have helped create a heightened demand for the natural or teardrop implants. As a result, women's expectations are that these anatomical implants will provide a "more voluptuous," "perfectly natural" shape,[37] a sentiment further reinforced in patients' minds by the higher retail price (average of $450 per pair[1]) commanded by implant manufacturers, and in surgeons' minds by manufacturers' professional newsletters.[38]

Discussions with many senior plastic surgeons find a near unanimous belief that anatomical implants *will* spin. Few state they use them. This phenomenon was recognized by Gerow.[39] In fact, in Cronin and Gerow's original treatise,[2] they state, "A Dacron mesh cemented to the back of the prosthesis fixes it to the chest wall." Many surgeons' convictions apparently were derived from experience gained using the "first generation" of anatomical implants from the 1960s through 1980s. With the demise of Dow Corning, Surgitek, and others, anatomical shaped implants were absent from the U.S. market until 1994. Like this author, any plastic surgeon completing training in the early 1990s would have no benefit of earlier personal experience using the prior generations of anatomical implants to warn of possible malposition concerns. What is perplexing is that a review of the scientific literature discovered a dearth of published knowledge regarding the possibility of anatomical implants becoming malpositioned. Furthermore, the Core Curriculum[40] guiding the training of young plastic surgeons is void of reference to this problem. Other training aids such as Selected Readings[41] show a similar deficiency. A few published reports[15,24,42–49] and verbal scientific presentations[4,30,50] made only brief mention of the risk of anatomical implant malposition. A survey of the average age of plastic surgeons using anatomical implants for augmentation could be enlightening.

Conclusions

This study strives to better understand possible causes of anatomical breast implant malposition, and to educate surgeons, young and old, as to special concerns associated with use of these devices. This author's series, with one exception (one patient with two McGhan style 163 implants), was made entirely of wide or horizontal Mentor anatomical (styles 2700 and 2900) Siltex implants. Although there is no intuitive reason to believe that the tendency for malposition would be significantly different with vertical or tall implants, conclusions here relate to the former style of implants rather than the latter. Further studies regarding rotational deformities of tall (vertical) implants are warranted.

The chief advantage of the teardrop or ana-

tomical implant over the round implant (i.e., its natural shape) may be its biggest drawback. The natural teardrop-shaped implant, once spun, can provide the most unnatural of breasts.

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Discussion

Breast Deformity Caused by Anatomical or Teardrop Implant Rotation

by John L. Baeke, M.D.

Discussion by David A. Hidalgo, M.D.

The phenomenon of anatomic implant rotation is well described in this study, and enough evidence is presented to support the author's conclusions. The size of the study population is adequate, and a single-surgeon study simplifies data interpretation. The variety of implant types included in the study suggests that anatomic implant rotation is caused by a generic shape difference compared with round implants and is not the fault of one particular device. Although most of the author's experience has been with low-height implants, this phenomenon also occurs in vertically tall anatomic implants (Fig. 1). Although only 25 percent of patients in this study had subpectoral implants, one can logically argue that pectoralis activity is more likely to increase than decrease the chance of rotation. The role of overfilling of the implants by an average of 40 cc on the potential for implant rotation is unclear. The mean size of implants used was approximately 390 cc. Therefore, overfill may not have been more than 10 percent, an amount unlikely to make the implants much stiffer or more globular in shape, themselves factors with unknown implications with regard to implant rotation. Neither size nor texturing of the implant was shown in this study to correlate with implant rotation.

Physician designers and manufacturers have coined the terms "anatomic" and "teardrop" to both distinguish these implants from round types and also perhaps to subtly imply ipso facto that they are somehow superior. Besides the potential problems described in this report, clear advantages of anatomic implants have never been well demonstrated in any publication or meeting presentation that I have seen. Anatomic implants often look different but not necessarily better or more natural than round implants. They can actually look quite "unanatomic" in some patients, producing a long breast when a vertically tall implant such as the McGhan style 468, for example, is used. Anatomic implants such as the Mentor Contour Profile where the y axis is shorter than the x axis can produce breasts that appear short and wide. Although these negative consequences can occur by the indiscriminate application of anatomic implants, it would seem logical that there are specific subsets of patients who might benefit from these variant designs when they are thoughtfully selected. Using the same examples, patients with low breast position and a narrow chest might actually look better with a more vertically long implant than with round implants. Similarly, a patient with a short, wide chest may benefit from the short wide implant type. Recognition of these specific conditions may allow the surgeon to achieve a better than usual result. However, for most patients, superiority of anatomic implants is unproven.

A study that compares the results of matched body types treated with round versus anatomic implants is desperately needed to determine whether there are benefits of using anatomic implants worth the additional risks. Such a study could determine whether there are truly shape advantages related to implant type, or whether an anatomic implant would permit a larger augmentation than a round type in the same setting with less tendency to cause an artificial appearance.

This study arms the clinician with scientific

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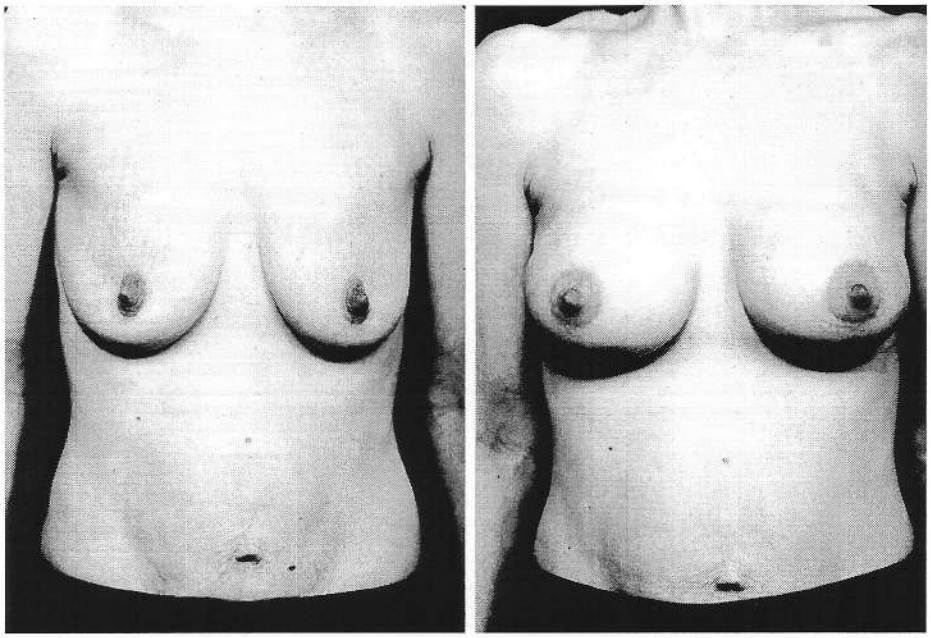

FIG. 1. (*Left*) Preoperative view of a patient with postpartum atrophy, a vertically long chest, and low breast position. Vertically tall McGhan style 468 textured implants were selected to specifically address this individual patient's breast and chest configuration. (*Right*) The patient is shown postoperatively. Both implants have rotated on the z axis to a horizontal orientation.

evidence to caution patients to whom manufacturers (and some practitioner Web sites) market directly and hype the visually appealing concept of a teardrop implant. Surgeons who feel pressured to embrace the anatomic implant concept should know that patients drop the subject quite readily when completely informed about these devices. Explaining the significant potential for implant rotation and that additional surgery may be required helps keep the verbally less appealing "round" implant option (who wants a round breast?) on equal footing.

What this study tells us most clearly is that using anatomic implants in the majority of patients will complicate the surgeon's practice by increasing the number of postoperative problems beyond those already seen from capsular contracture, implant position asymmetry, rippling, and incorrect implant size selection. Given the variables of incision location, pocket plane, implant filler type, and implant size, adding implant shape as another option can be expected to detract from the goal of achieving an ideal result as much as improving the prospect of achieving it. The number of suboptimal results and revisions will increase as a result of implant rotation problems associated with indiscriminate use of anatomic implants.

The optimal approach in using anatomic implants lies somewhere between using them for most patients versus only for a selected few, but probably the fewer the better. Using anatomic implants on a small subset of breast augmentation patients may improve overall results in difficult patients and minimize the total occurrence of rotation problems in a surgeon's practice. However, just like the case of vertical scar mammaplasty where there is the promise of better shape at the expense of a higher revision rate, these devices may not prove universally popular in the long term.

Anatomic implant design raises other issues not addressed by this study. Does the asymmetric shape distribute pressure within the shell unevenly in a way that increases the deflation rate? One patient in my practice exhibited bilateral premature implant deflation in which the shell defect was found at the peak of the vertically tall implant on both sides. Although anatomic implants may be here to stay, more studies are needed to elucidate both the advantages and drawbacks of these devices. Dr. Baeke has taken the first step in this direction and it is hoped that others will follow.

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