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Pectoralis Major Muscle Flap: A New Support Approach to Mammaplasty, Personal Technique

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Abstract. Despite the significant evolution of mammaplasty techniques, some undesirable changes on the operated breasts result in evident dissatisfaction for both patients and doctors. The main reason is that the breast has a tendency to resume its previous shape months after the operation. In pursuit of a procedure that would avoid this untoward morphologic evolution, we set to work on the development of a new approach of broad fixation to maintain the breast shape and to avoid ptosis by using the inferior third of the *pectoralis major* muscle. The authors report their experience with 46 consecutive cases of breast reduction and mastopexy operated between March 1994 and November 1995, studying the surgical procedure employed, its advantages, limitations, and possible complications.

Key words: Mastoplasty—Breast ptosis—Pectoralis major muscle

Introduction

Breast ptosis is usually an acquired phenomenon resulting from inadequate relationship between the breast continent (skin) and its content (gland). Distention of the skin and/or glandular-adipose volume loss with posterior nonadaptation of the skin (elasticity and retraction capacity decrease) results in a continent larger than its content.

A constant and common concern among many authors is avoiding breast ptosis. Several technical resources have been in use since the last century to prevent this. In 1882, Thomas Gaillard [14] described an incision placed at the level of the submammary fold to remove benign tumors, by which the breast was raised and attached to the second rib cartilage. Dehner [12] promoted an elliptical resection of the breast upper portion with posterior fixation to the third rib periosteum. Dartigues [11] secured the gland to the fascia of the *major pectoralis* muscle and Göbell [13] reported suspension of the breast by means of fascia lata strips fastened to the third rib.

Fixation of the gland to the thoracic wall by means of deep sutures is used nowadays by a large number of surgeons, having become widely known through Arié [2] and Pitanguy [20].

In 1987 we detected the possibility of obtaining better aesthetic results through modification of the breast architecture by means of three interposed breast tissue flaps [4–8]. The end in view was to provide reduction of the breast base and axillary pole and a more medial position of the lateral pole, which, besides conveying a substantial conification of the breast tissue, would also help project the areolomamillary complex to its apex. This technique favors a more effective and lasting breast shape besides maximum preservation of the skin covering and reduced postoperative ptosis.

Based on Daniel Milton's procedure [10], we began to associate the primary approach to breast tissue to a muscle approach for support of the breast shape.

This technique is based on the *pars abdominalis* of the *pectoralis major* muscle, which is positioned on the inferior breast pole and tractions the gland upward to restrain the action of gravity.

Anatomical Considerations

Knowledge of certain anatomical details of the *pectoralis major* muscle leads to a better understanding of why this procedure does not substantially alter the anatomy and function of said muscle.

The *pectoralis major* muscle has three main origins

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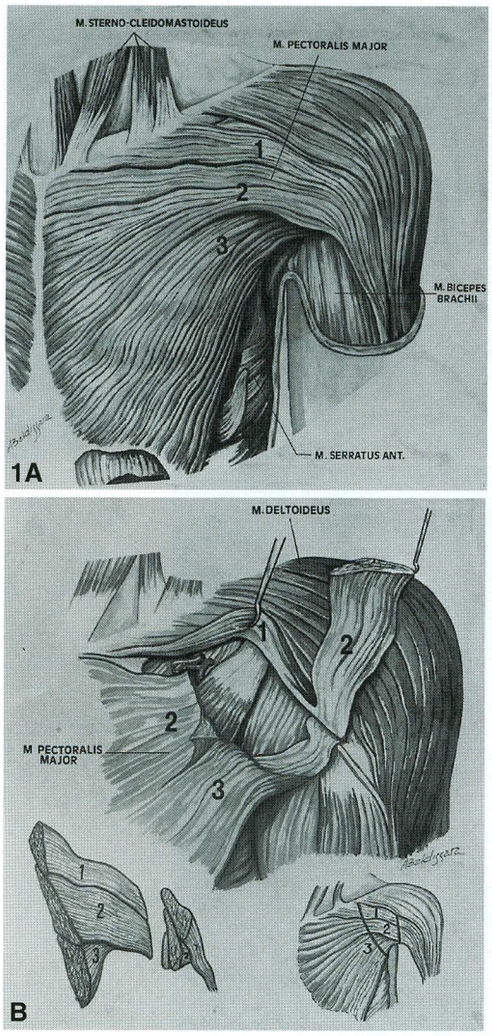


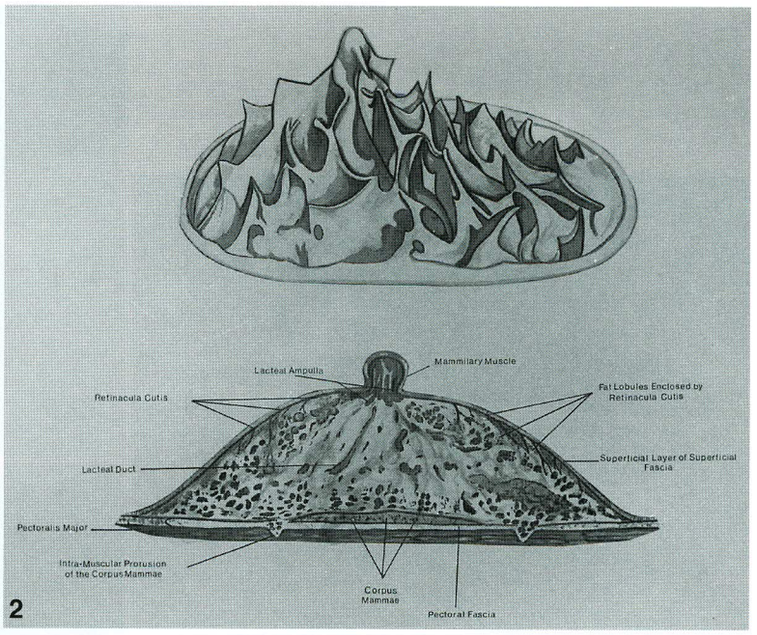


Fig. 1. (A) The three portions of the *pectoralis major* muscle converge like the leaves of a fan and present single insertions at the larteral border of the intertubercular sulcus of the humerus. **(B)** When the sternal portion (*2*) approaches the axilla, it will progressively cover the abdominal portion (*3*). Both compose a single body medially but are individualized near the humerus.
Fig. 2. Top: Cooper's ligaments of the breast (from Ref. [1], p 355).
Bottom: Intramuscular protusion of the corpus mammae (from Ref. [1]).

(clavicular, sternal, and abdominal) and fibers that emerge from the second to the sixth rib cartilages.

The abdominal portion arises from the sternal distal third, from the *rectoabdominal* muscle sheath and aponeurosis of the external oblique muscle [15,26]. In a lateral and cranial direction and crossing below the clavicular and sternal portions, the abdominal portion inserts on the lateral lip of the bicipital groove at a more posterior and deep position than the clavicular and sternal muscular fibers, without participating of the anterior axillary pillar (Fig. 1).

The breast tissue in contact with the *fascia pectoral* presents a number of small prolongations that insert into the muscle (Fig. 2).

The blood supply is type V, with one dominant vascular pedicle and a number of secondary segmental pedicles. The dominant pedicle is based on the thoracoacromial artery and the secondary segmental pedicles are based on the internal thoracic artery [22]. The fourth perforant of the internal thoracic artery and the terminal segment of the pectoral artery, a branch of the thoracoacromial artery, supply the inferior third of the muscle. Besides this, other ramifications of the lateral thoracic artery and intercostal arteries contribute to the blood supply (Fig. 3).

The superior portion of the muscle is enervated by the medial pectoral nerve (C8 and T1), while the inferior third is enervated by the lateral pectoral nerve (C5, C6, and C7).

The inferior third of the muscle promotes the final movement of aduction and internal rotation of the humerus, a function of little significance.

Materials and Methods

A prospective study of 46 consecutive cases of breast reduction and mastopexy was carried out with this personal technique from March 1994 to November 1995.

Expectations of the patients are to obtain a conical breast shape, a well-defined position on the thorax, and a permanent result.

The age group varied between 17 and 64 years of age, with a predominance of patients aged between 30 and 39 years (Table 1).

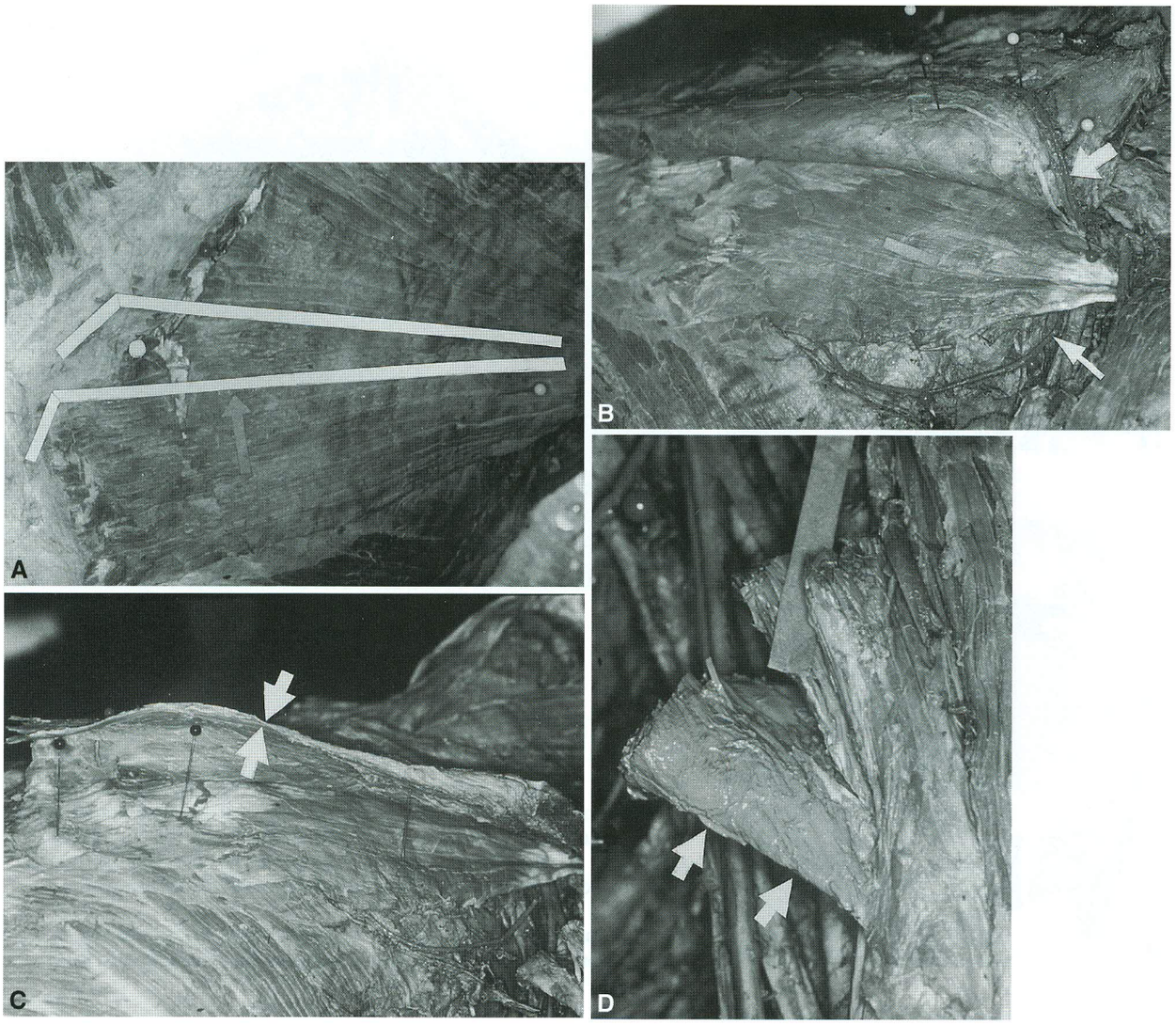


Fig. 3. Anatomic study showing **(A)** where the fourth *perforans* of the thoracic artery is based in relation to the parasternal border (*white dot*). The muscle incisions used to shape the flaps can be carried out on the superior or inferior limits related to the projection of this *perforans*. **(B)** The pectoral artery, a branch of the thoracoacromial artery, slides over the deep surface of the *pectoralis major* muscle, penetrates the muscle, and is anastomosed with the *perforans* branches of the internal thoracic artery (*large arrow*). The lateral thoracic artery circles the lateral margin of the tendon of the *pectoralis minor* muscle and continues 4–5 cm along its lateral border before being buried in the *pectoralis major* muscle (*small arrow*). **(C)** The thickness of the muscle will define the variant to be used. **(D)** Detail of the insertions of the *pectoralis major* muscle. The *pars abdominalis* penetrates the humerus intertubercular sulcus more posteriorly and deeply than the clavicular and sternal portions.

Table 1. Major pectoralis muscle flap in mammaplasties: Age group (March 1994–November 1995, 46 cases)

Age group	No. of patients	Percentage
11–19	1	2.17
20–29	8	17.39
30–39	17	36.96
40–49	13	28.27
50–59	5	10.86
60–69	2	4.35

Table 2. Major pectoralis muscle flap in mammaplasties: Type (March 1994–November 1995; 46 cases)

	Variant a		Variant b	
	No.	%	No.	%
Type 1	3	21.43	11	78.57
Type 2	7	26.02	19	73.08
Type 3	2	33.33	4	66.67
Total	12	26.09	34	73.91

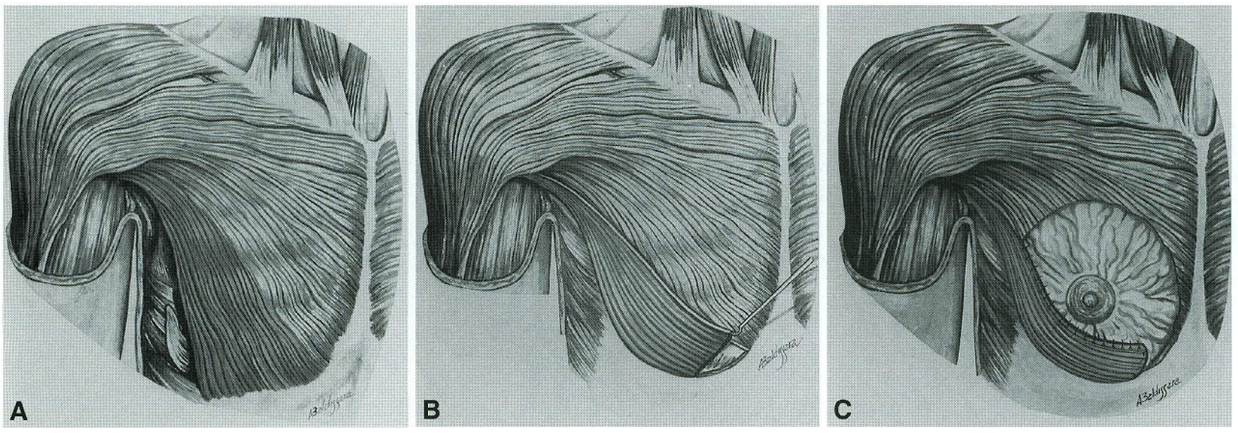


Fig. 4. **(A)** Procedure Type 1 consists of using the muscle portion situated caudally to the fourth *perforans* of the internal thoracic artery. **(B)** By undermining and medial desinsertion of the muscle **(C),** the breast tissue pocket is shaped.

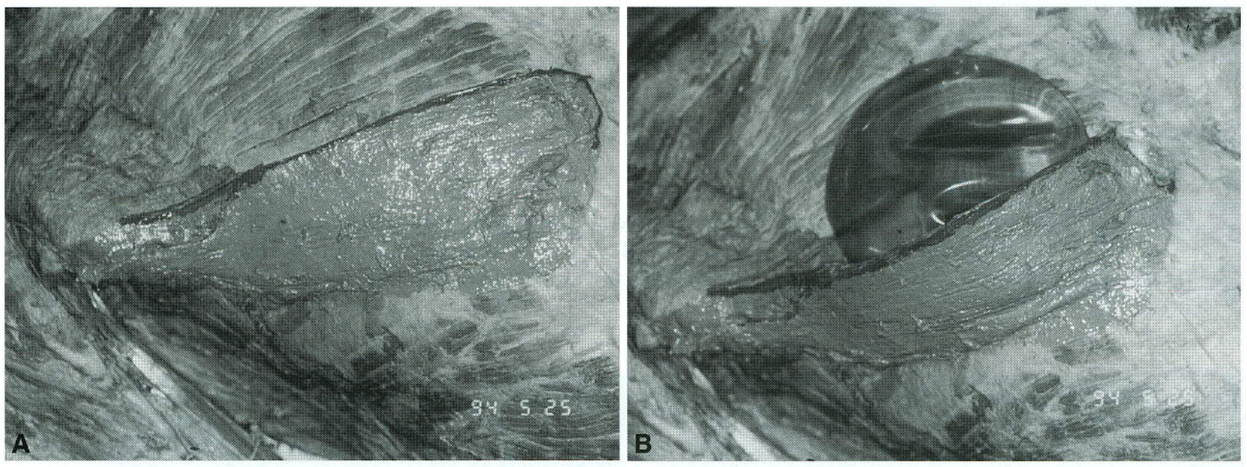


Fig. 5. **(A)** Cadaver study of procedure Type 1 **(B)** simulating the resulting effect with a breast prosthesis.

The objective is to transform the inferior segment of the *pectoralis major* muscle into a breast tissue supporting element. The inferior third of the muscle (*pars abdominalis*) is utilized in different forms of flaps. In this particular portion the muscular thickness is relatively thin in women (0.5–0.8 cm), which permits satisfactory mobilization and manipulation [15,17,22].

The projection of the fourth perforant of the internal thoracic artery will define the level of the muscular incisions and the different types of flaps to be used in this technique [9,16].

Surgical Technique

The patient is placed in the prone position, with the dorsum at 45° and arms abducted. This will allow visualization of the breast in a natural position.

Skin marking will depend on the type of the breast, preference being given to skin resections that result in minimal scars and a tensiless wound closure.

With the breast firmly secured at its base, skin incision is carried out, followed by Schwartzmann's maneuver in a medial–dermal undermining, then cutaneoglandular and musculoglandular undermining of the inferior half of the breast [4–7].

Glandular resection will depend on the deformity to be corrected and on the resultant breast size desired. Reshaping of the breast tissue begins by preparation of three triangular flaps—medial, central, and lateral—posteriorly interposed, which will produce a conical shape.

Three types of *pectoralis major* muscle flaps can be prepared according to the anatomic and histologic type of the breast (Table 2).

- Type 1. The muscle is deeply incised in the same direction as its fibers. The incision is made in the inferior boundary of the fourth perforant of the internal thoracic artery. The muscle fibers are separated caudally with medial desinsertion of the muscles, thus forming the muscle pocket. The infe-

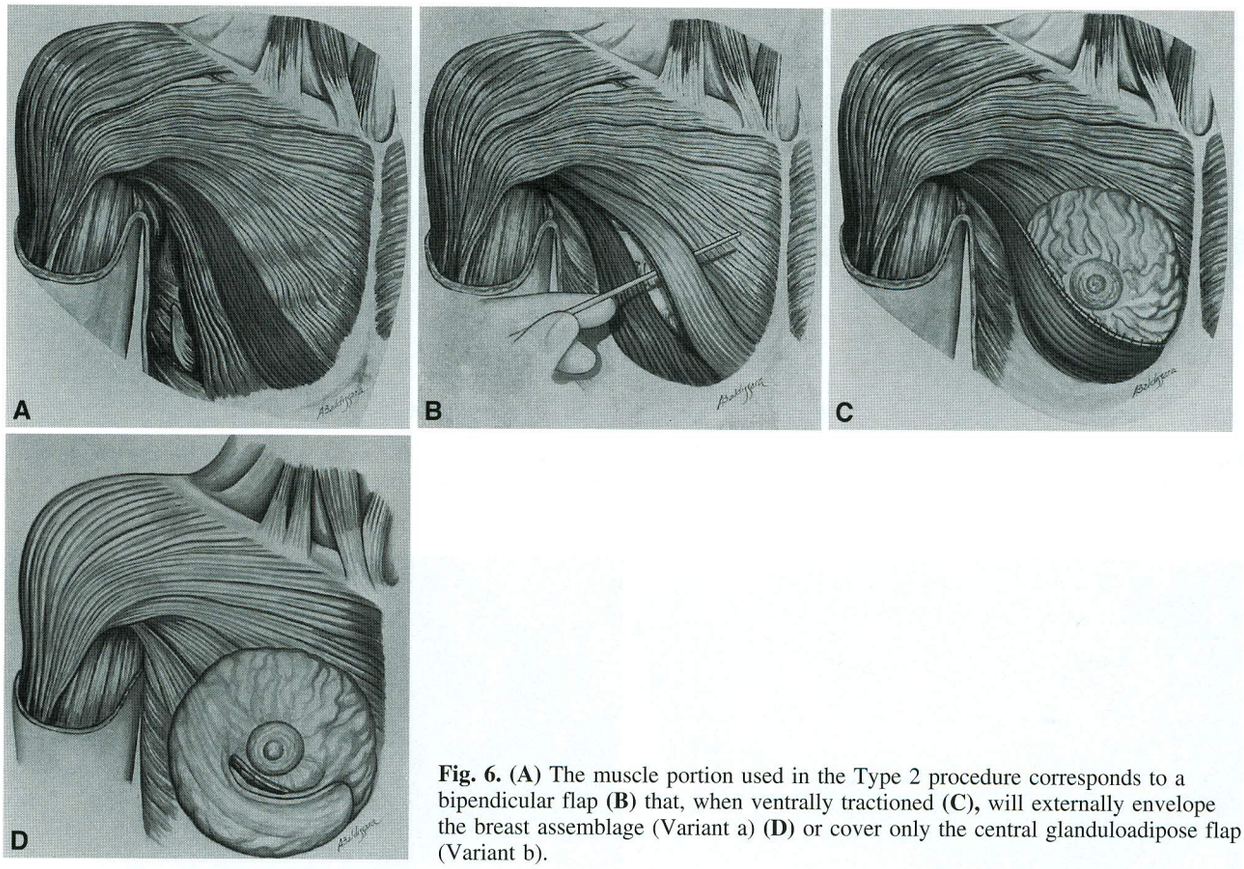


Fig. 6. **(A)** The muscle portion used in the Type 2 procedure corresponds to a bipendicular flap **(B)** that, when ventrally tractioned **(C),** will externally envelope the breast assemblage (Variant a) **(D)** or cover only the central glanduloadipose flap (Variant b).

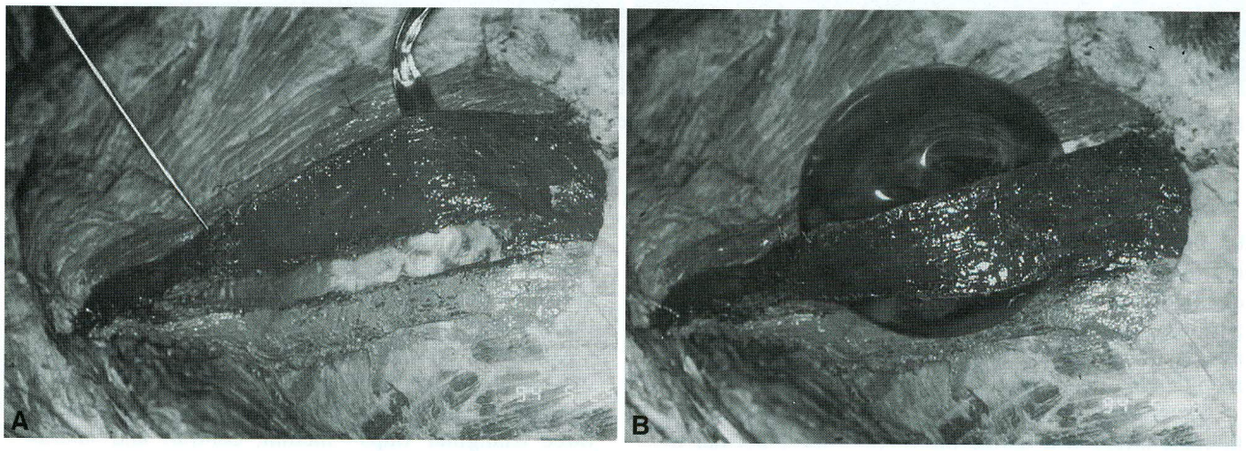


Fig. 7. **(A)** The muscle segment in the Type 2 procedure **(B)** envelopes the breast gland, simulated in this example by a silicone gel breast implant.

rior/lateral breast pole is inserted in this muscle pocket and secured with several sutures (Fig. 4).

This type is indicated for glandular breasts of moderate to large size with minor axillary projection (Fig. 5).

- Type 2. Two parallel incisions are carried out on the *pectoralis major* muscle in the same direction of its fibers. The variation distance between these two parallels is of 4–5 cm. The muscle flap is tractioned anteriorly and the borders of the *pectoralis major* are sutured with 3.0 mononylon. The flap will cover part of the inferior/lateral pole where it will be secured (Fig. 6).

This type is indicated for breast of glandular/adipose content with major axillary projection (Fig. 7).

- Type 3. Similar to Type 1, it consists of the preparation of a muscle pocket, although here the incision

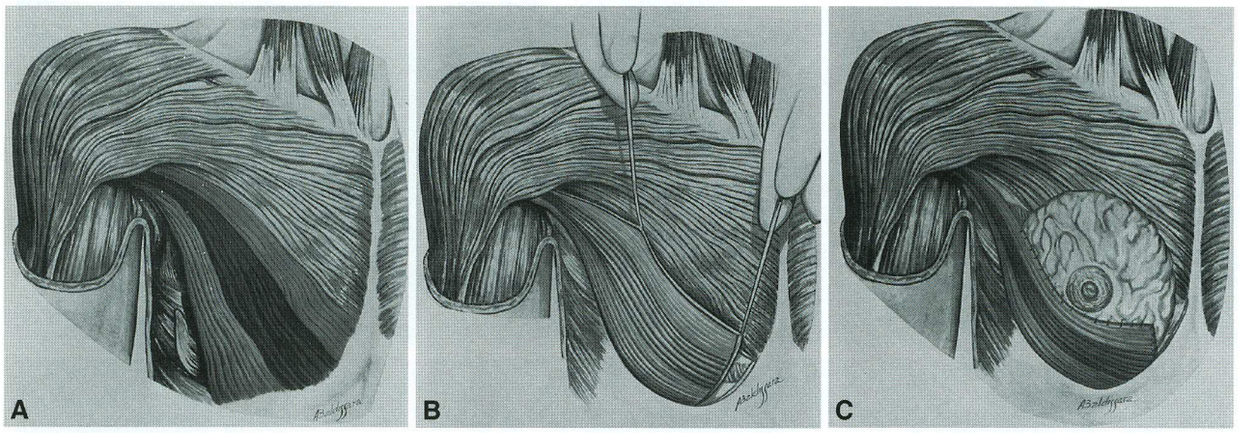


Fig. 8. **(A)** In the Type 3 procedure the three portions of the *pars abdominalis* are used, **(B)** with its desinsertion compromising the fourth *perforans* of the internal thoracic artery. **(C)** A larger pocket that will cover the inferior hemisphere and the breast tissue lateral pole is fashioned.

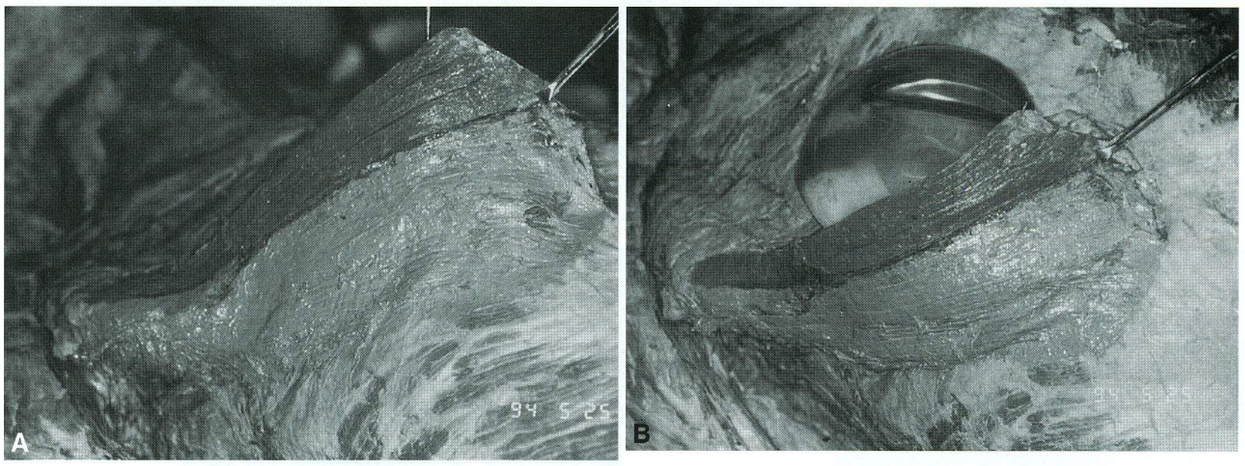


Fig. 9. **(A)** Cadaver study of the Type 3 procedure **(B)** simulating the resulting effect with a breast implant.

is performed in a cranial position to the projection of the fourth perforant of the internal thoracic artery. Medial desinsertion of the muscle is carried, out as well as ligature of the perforant (Fig. 8).

Type 3 is indicated for adipose breasts with discreet axillary projection (Fig. 9).

The three types can be used in two ways.

Variant a. The muscle flap involves externally the breast assemblage (lateral, central, and medial breast flaps) (Fig. 10); this variant is used when the muscle is underdeveloped (Fig. 11).

Variant b. The muscle flap is anchored directly on the breast tissue central flap, which promotes internal support to the medial and lateral flaps. This variant is used when the muscle is thicker and larger (Fig. 12).

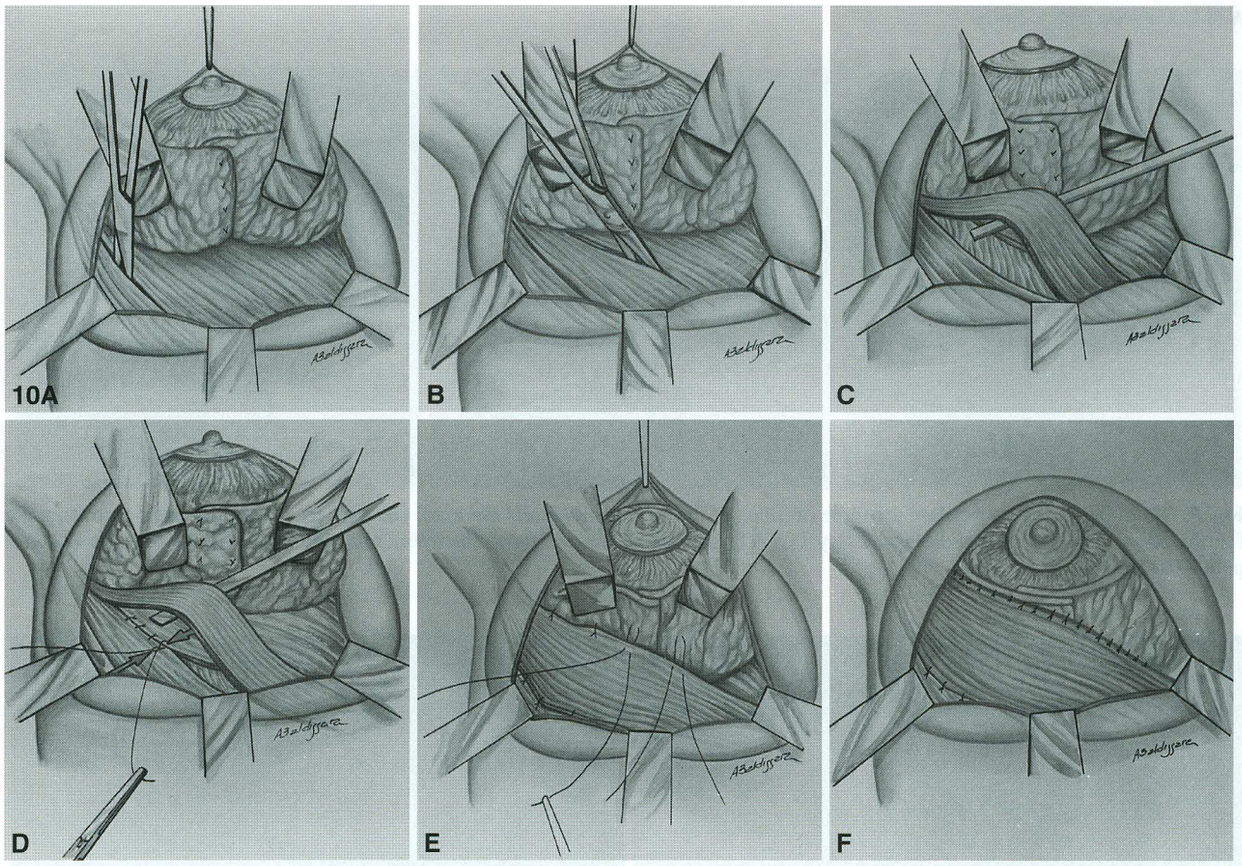
We use suction drains due to the wide glandular and muscle undermining. The subcutaneous tissue is sutured with 4.0 mononylon separate stiches. Skin excess resection is carried out in such a way that closure of the wound borders is undergone with no tension. The skin is distributed around the nipple with eight 6.0 mononylon Gillies stitches followed by mononylon intradermic continuous sutures. In the case of any vertical or horizontal incisions, closure is made with intradermic continuous sutures.

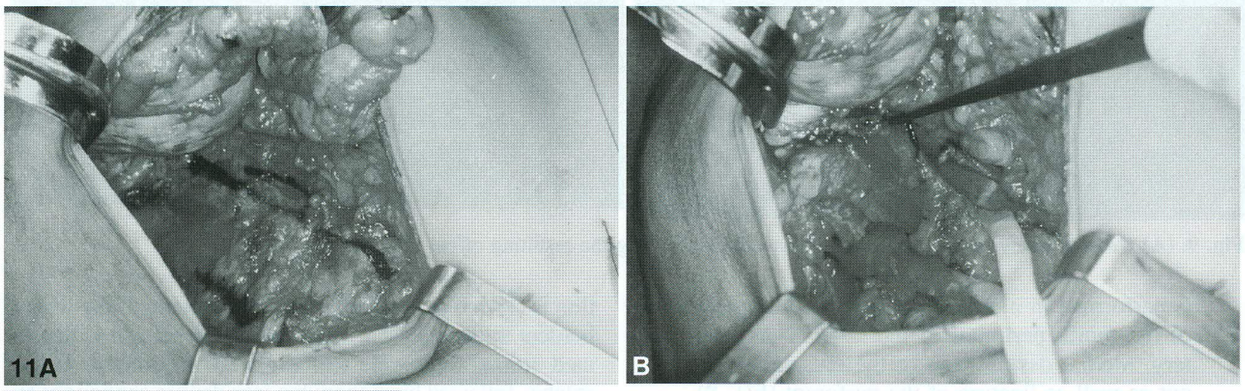
We request patients to begin pectoral muscle contraction exercises after the seventh day to traction the breast upward and thus eliminate any traction over the wounds.

Discussion

The various techniques for breast reduction and mastopexy present medium- and long-term temporary results since breasts show a tendency to resume their previous contour, even with standard procedures using gland fixation on the fascia of the *pectoralis major* muscle.

In order to avoid breast ptosis, some authors use muscle strips that enfold the inferior glandular flap pedicle. This flap should be large enough to avoid the mammary assemblage sliding over it [10].





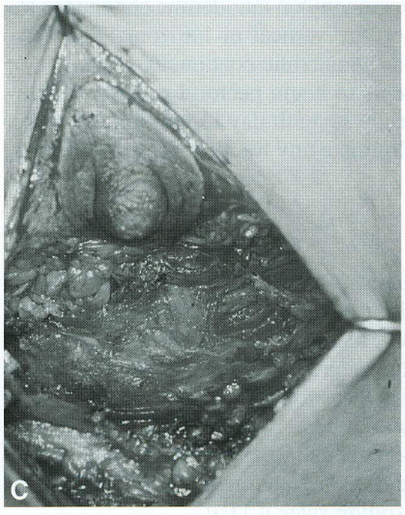


Fig. 10. **(A, B)** Drawings showing the Variant a procedure and the Type 2 procedure. Shaping of the bipedicular muscle flap. **(C, D)** The flap is raised and the borders of the *pectoralis major* muscle are sutured. **(E, F)** External fixation of the muscle flap to the glanduloadipose tissue.

Fig. 11. **(A)** Transoperative views of how the muscle is approached in the Type 2 a procedure. **(B)** Marking the incisions on the *pectoralis major* muscle. **(C)** To exemplify better, the shaped bipedicle flap is tractioned ventrally with the aid of a rubber band. The muscle is in place and covering the inferior breast pole.

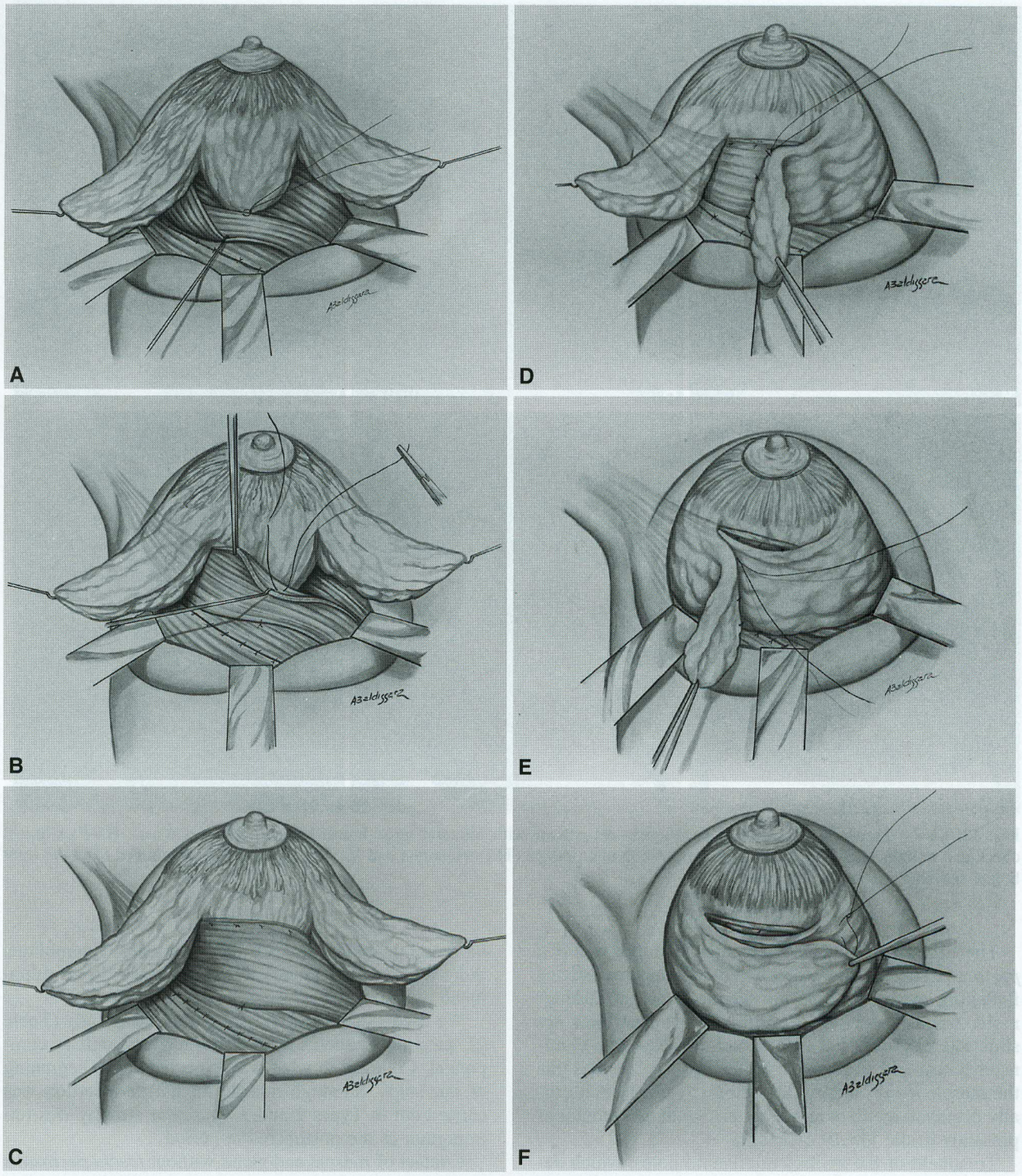


Fig. 12. **(A–C)** In the Variant b procedure the muscle flap is sutured directly on the central glanduloadipose flap. **(D, E)** The medial flap is rotated and deeply secured to the muscle **(F),** and consecutively the lateral flap is transposed over the medial one.

Other authors have also used original breast components as dermal flaps [24]. For internal fixation these flaps need sufficient length to allow anchorage of the dermis to the pectoral muscle. Besides, there is the disadvantage of limitations inherent to periareolar techniques.

The glandular nature of some breasts permits better maintenance of the superior breast pole shape and volume. Tissue redistribution and long-term support obtained with the technique we present here also achieve this objective in cases of breasts with a glanduloadipose content (Fig. 13).

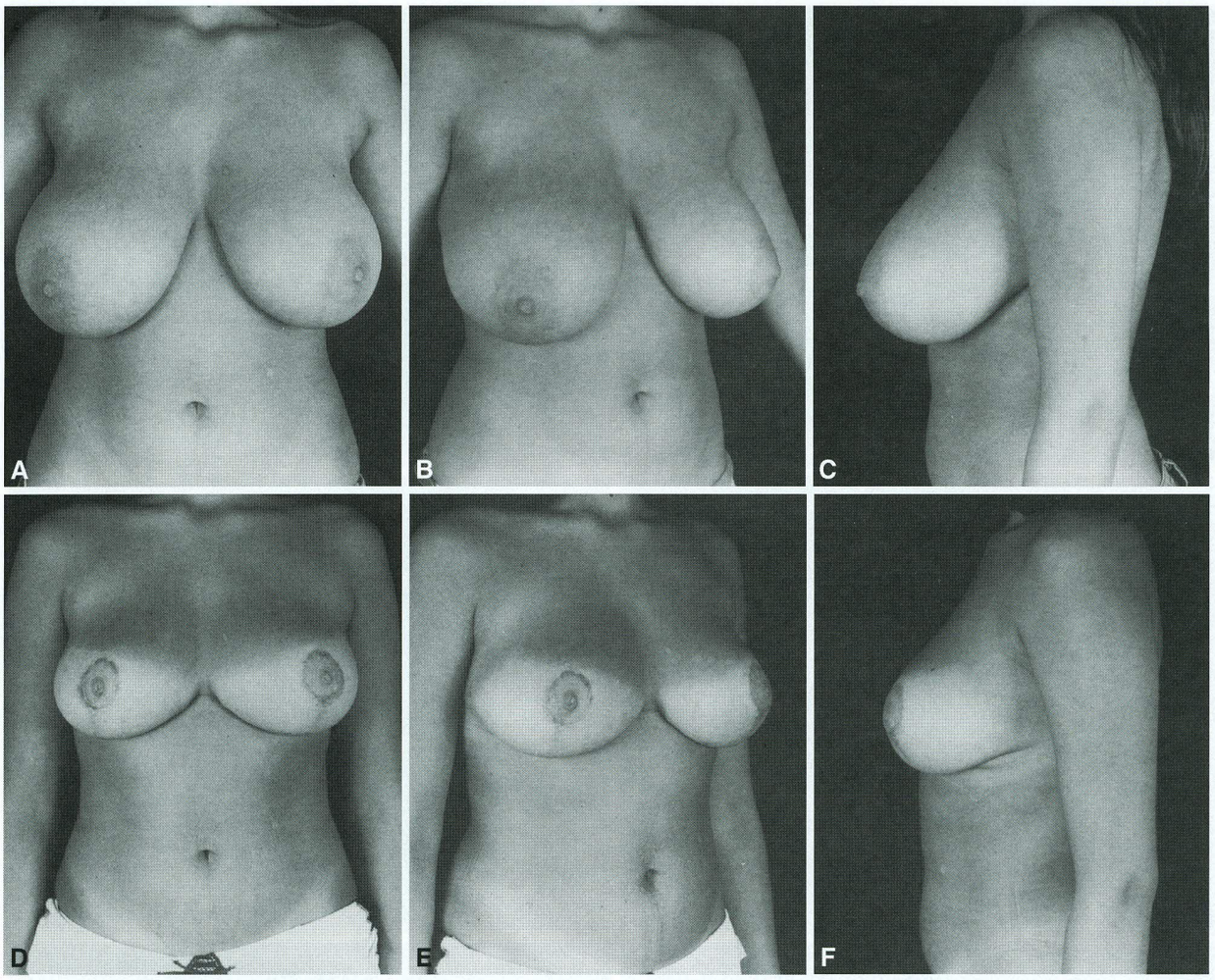


Fig. 13. **(A–C)** Preoperative views of an 18-year-old patient with bilateral large breast hypertrophy and ptosis. **(D–F)** Clinical checkup 8 months after surgery using the triple-flap interpostion (TFI) technique and Variant 3 a (900 g was removed from the right breast and 850 g from the left one).

The vertex of the breast is secured with the use of a *pectoralis major* flap, which avoids any anteroposterior flattening and prevents loss of the breast height; furthermore, when in the prone position, the breast does not slide laterally over the thorax and consequently eliminates breast and areola deformity (Fig. 14). Besides this the muscle avoids a definite sliding movement that usually occurs at medium and long term with all techniques presently in use [18,19,21,23,25].

Treatment of the axillary and lateral poles, which decreases and medializes its contents, plus correction of breast asymmetries present much more effective results (Figs. 15 and 16). We believe that this technique also offers greater support and protection to breast implants.

One other advantage of the muscle flap is a decrease in postoperative complications. The muscle removes the weight of the breast over the scar and consequently prevents enlargement and formation of hypertrophic scars. Postoperative rest is also discontinued.

Contraction of the muscle promotes an ascendant and harmonious movement of the mammary assemblage, more intense in women with marked muscular development.

We used Type 2 and Variant b more frequently (Table 2) since most patients presented important axillary component. Contrary to what was expected at the beginning of our study, although muscle medial desinsertion was carried out in Types 2 and 3, muscular atrophy was unimportant in the postoperative period.

Contact of muscle and gland without *fascia pectoralis* mediation does not presuppose an anatomical aggression because under normal conditions the muscle is intimately related with the glandular parenchyma through glandular projections introduced in the muscular tissue.

This technique proposes a muscular transposition for support of the mammary assemblage and consequent construction of an internal "brassiere," which avoids the complication hazards when aloplastic materials are used [3].

A dynamic breast deformity was the major complica-

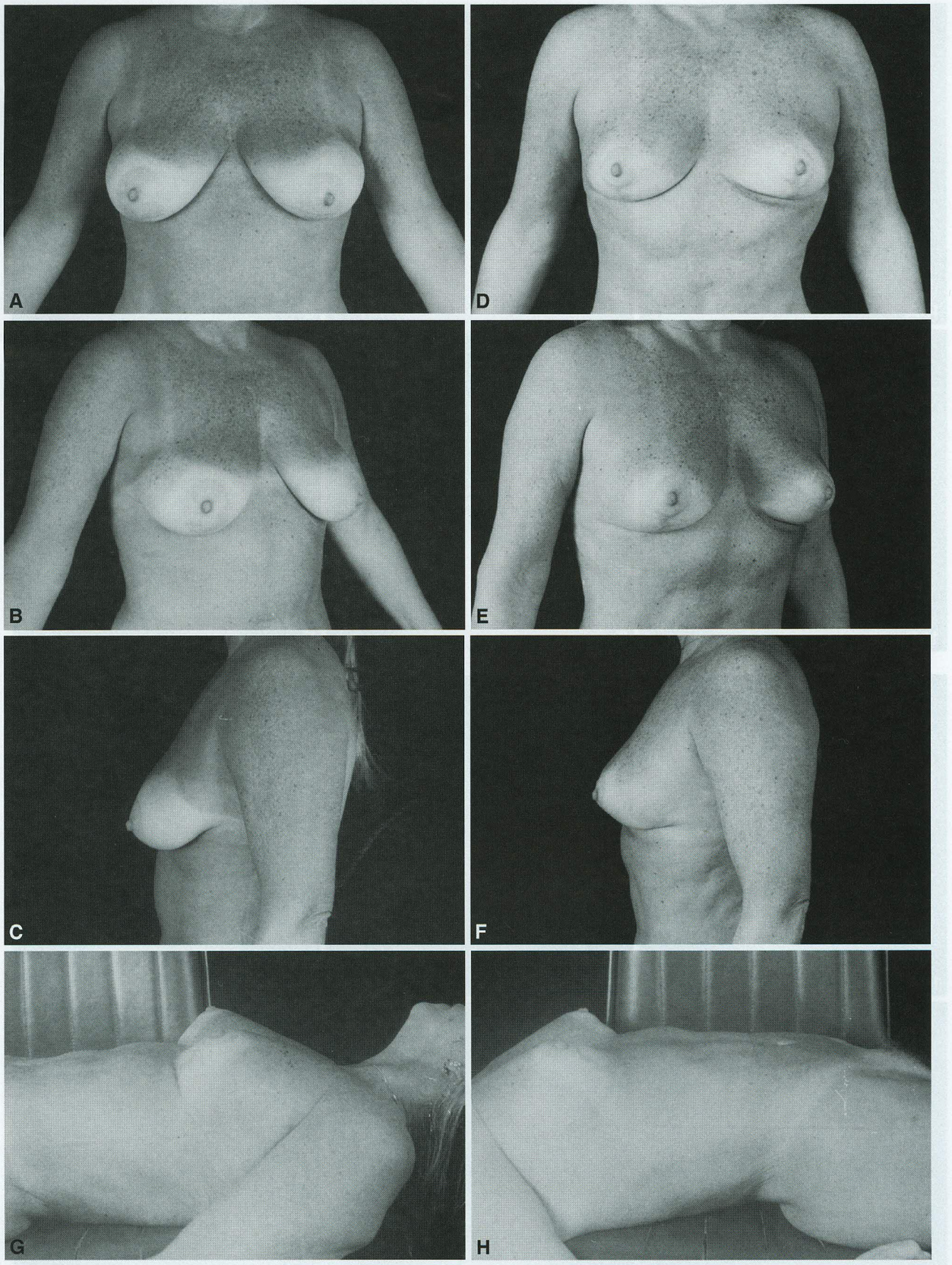
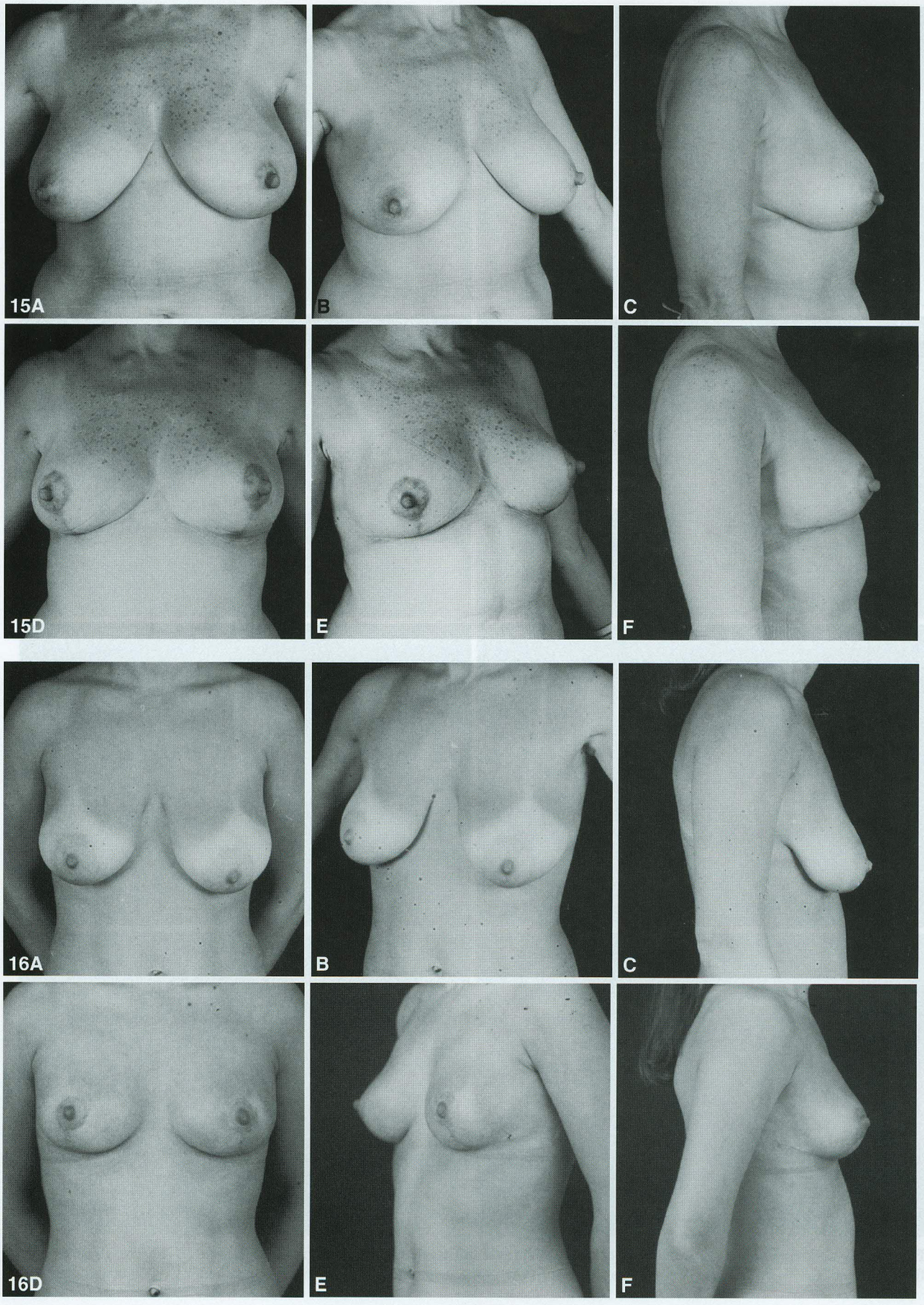


Fig. 14. **(A–C)** Preoperative views of a 42-year-old patient with moderate hypertrophy and a large base. **(D–F)** The 18-month result following the TFI technique and Variant 1 a. **(G, H)** In the prone position, note how the breast maintains its conical shape.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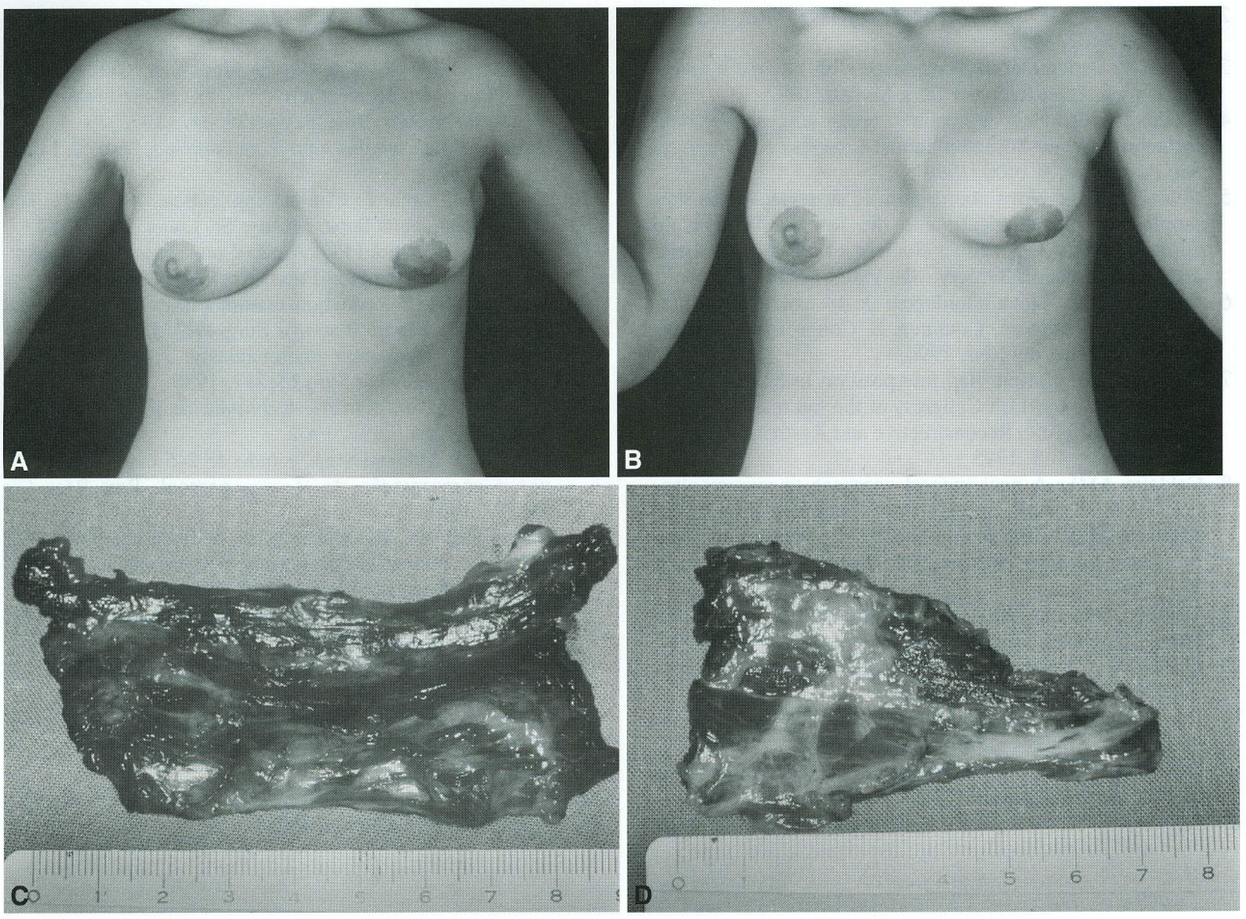

Fig. 17. **(A)** Athlete patient at rest and **(B)** contracting the pectoral muscles. A more conspicuous breast deformity can be observed on the left breast. **(C)** Muscle segment resected from the left breast. **(D)** Muscle segment resected from the right breast.

tion observed with the use of the *pectoralis major* muscle. In three patients operated with Variant a the muscle excessively tractioned the latero-inferior portion of the breast. One of these cases underwent muscle resection under local anesthesia and in the other two the muscle was repositioned using Variant b. We believe that even in athletes, in whom muscles are much more developed, the use of this technique, Variant b in particular, promotes an overall upward traction of the breast assemblage that prevents breast ptosis. Figure 17 shows an athlete female patient with a predominantly adipose breast and some preoperative asymmetry. The left breast was smaller than the right one, and since the patient did not wish to insert a breast prosthesis or decrease the size of the right and larger breast, we carried out the Type 2 a procedure on the right breast and the Type 3 a on the left one to increase its size. The excessive muscular mass on the left breast promoted excessive traction over the lateroinferior portion of the breast, appearing even more intense under voluntary contraction. The muscle segment was then resected on both breasts.

Fig. 15. **(A–C)** Preoperative views of a 49-year-old patient with mild breast hypertrophy and an important axillary and lateral pole. **(D–F)** Postoperative views 6 months after the TFI technique and Variant 2 a showing the conical shape of the breast.

Fig. 16. **(A–C)** Preoperative views of a 27-year-old patient with ptosis and an important sideways-deviated breast. A mild degree of asymmetry can be observed. **(D–F)** Postoperative views 10 months after the TFI technique and Variant 2 b. Note the satisfactory projection achieved and the corrected asymmetry.

Conclusion

We propose an integrated treatment of the mammary region with interposition of three breast tissue flaps and a posterior approach to the *pectoralis major* muscle with any of the three types offered. The muscle flap provides blood supply to the breast tissue flaps and, at the same time, preserves the new breast shape.

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