Delayed Breast Reconstruction with Temporary Expanders and Definitive Implants

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31.1 Introduction

Delayed breast reconstruction is considered to be the technique of choice for restoring the physical integrity of mastectomized patients. However, some decades ago, breast reconstruction could not be performed until 2 years or even 5 years after oncologic treatment. Doubts as to whether the reconstruction would cause negatively affect the proper clinical follow-up of patients remained at that time. This changed in the 1980s, when earlier delayed breast reconstruction techniques began to disseminate, as it was proved that surgery before 5 years postoperatively had no additional oncologic risk for the patient [1, 2]. Many reconstructive options were developed following this period, culminating with autologous tissue reconstruction, which is one of the most important techniques in delayed breast reconstructions [3, 4].

Nevertheless, autologous tissue reconstruction is not always possible, owing to the patient's anatomy or preferences, the latter of which takes into account the relative magnitude of the procedure in terms of invasiveness and morbidity. This renders implant-based breast reconstruction notable for its surgical simplicity and applicability. Thus, implant-based breast reconstruction is a straightforward, less invasive approach, capable of resulting in reasonable outcomes in reconstruction, with a faster recovery time [5]. Implant-based breast reconstruction comprises two techniques: definitive implant (primary or one-stage implant) and tissue expander/implant (secondary or two-stage expander/implant reconstruction). These techniques can be combined or not combined with autologous tissue reconstruction.

Despite the fact that implant-based delayed breast reconstruction is already widely used, there are some patients who still do not benefit from this procedure. The aim of this chapter is to describe the indications, preoperative evaluation, operative technique, and complications related to implant-based delayed breast reconstruction.

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31.2 Indications and Selection of Patients

31.2.1 Timing of Reconstruction

As already described in this book, a reconstructive technique can be employed during a mastectomy (immediate) or in a subsequent operation (delayed). Delayed reconstructions can be performed at any time, given that the wound has healed and adjuvant therapy has already been completed. Also, prior to the procedure, the postirradiation acute skin lesions and the hematologic effects of chemotherapy should have ceased [6]. Different from the immediate approach, the delayed one is correctly indicated for patients who have impaired perfusion of skin flaps after mastectomy or traumatized tissue [7]. Therefore, it is useful for the patient who has medical comorbidities such as active smoking, obesity, and cardiopulmonary disease, as these conditions might predispose to poor perfusion of tissues. The physician is compelled to consider the risks and benefits of the delayed timing. Advantageous points to be taken into consideration are that delayed reconstruction allows one to be certain of clear margins prior to the procedure, minimizes the effect of poorly perfused mastectomy skin flaps on the quality of the reconstruction, and permits the

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completion of the adjuvant chemotherapy. Moreover, there are series demonstrating that delayed reconstruction has fewer complications than immediate reconstruction [8]. However, the technique might entail another surgery in order to ameliorate the esthetics, thus prolonging the overall treatment of the patient, because it provides poorer cosmetic quality than immediate reconstruction [7]. Furthermore, delayed reconstruction has limited reconstructive options following radiotherapy.

31.2.2 Implant-Based or Autologous Techniques

Delayed reconstruction can be implant-based or autologous-flap-based. The implant-based reconstruction involves the use of silicone-filled or saline-filled implants or a tissue expansion device beneath the remaining mastectomy skin flaps and the pectoralis major muscle. Autologous-flap-based reconstruction uses musculocutaneous flaps, which consist of a segment of vascularized muscle with the overlying skin and fat, which are perfused by perforating vessels from the underlying muscle. Although the result is overall more pleasing in appearance with a musculocutaneous flap [3, 4, 7], there are some disadvantages, which include longer surgical duration and prolonged postoperative recovery when compared to implant-based reconstruction. The advantages of the implant-based over the flap-based technique are surgical simplicity, the absence of donor site morbidity, reduced operating time, and more rapid postoperative recovery when compared with purely autologous reconstructions [9, 10].

31.2.3 Definitive Implants or Expander/Implants

The definitive implant is also termed "primary implant reconstruction" and, although correctly applied in an immediate setting, it is useful as a one-stage delayed implant reconstruction. The expander/implant or secondary reconstruction differs in that it occurs in a two-stage approach. The indication for the appropriate surgical technique requires two important clinical evaluations: the musculocutaneous condition of the thoracic wall subsequent to the mastectomy and the size and ptosis of the contralateral breast. For instance, the complete absence of the pectoral muscles owing to a mastectomy using the Halsted technique [11] and postoperative radiotherapy are two clinical conditions which may contraindicate reconstruction with definitive implants or temporary tissue expanders. The reason for this is that there is an increased risk of an unsatisfactory esthetic result—asymmetry, contracture, and pigmentation [12]—associated with the additional risk of postoperative complications.

Fig. 31.1 Example of a case with good local conditions for delayed breast reconstruction with definitive implants

Fig. 31.2 Example of a case in which reconstruction with a definitive implant is contraindicated owing to late side effects of radiotherapy

31.2.3.1 Indications for Definitive Implants

Patients who are allowed to undergo definitive implant delayed breast reconstruction should have a preserved pectoralis major muscle, sufficient amount of skin, and preserved subcutaneous tissue flaps resulting from mastectomy, and should not have had radiotherapy. Additionally, the contralateral breast must be small to medium-sized and minimally ptotic or nonptotic (brassiere size A cup or B cup). It is also indicated for those patients whose breasts have been previously augmented, as the skin and soft tissues have already expanded (Fig. 31.1) [13].

31.2.3.2 Contraindications for Definitive Implants

Patients in this group have an absent pectoralis major muscle, rather tense cutaneous flaps, scars from very wide mastectomies, previous radiotherapy or a large, ptotic contralateral breast (Fig. 31.2). Such women need greater

expansion and possibly require a contralateral breast procedure to improve the outcome.

31.2.3.3 Indications for Temporary Expanders

Tissue expansion prior to the definitive implant is the first stage in the two-stage technique. The expander is used to distend the cutaneous flaps and to obtain more volume when the definitive prosthesis is inserted. It is indicated in a similar fashion to definitive implants. Also, older patients, those with significant medical comorbidity, and women with minimal abdominal tissue, in whom the autologous technique would be unsuitable, also benefit from this technique. Besides, the expander/implant technique is indicated for those patients devoid of sufficient skin or preserved subcutaneous tissue in flaps resulting from mastectomy. This may occur when there is little elasticity of the cutaneous flaps from mastectomy or in the case of a contralateral breast with a rather large volume. In these situations, the two-stage implant reconstruction usually yields esthetically superior results (Fig. 31.3).

31.2.3.4 Contraindications for Temporary Expanders

These are basically the same as those for the use of definitive implants, with even more emphasis on the risk of expanders after radiotherapy [14]. A large number of authors have realized that several postoperative complications can ensue when attempting to distend previously irradiated tissues [12, 14–16], since the radiation decreases the elastic distension capacity of the tissue. In these cases, the most frequent complications are painful and difficult expansion with possible extrusion of the expansion device or periprosthetic capsule (Table 31.1). Even though one achieves the final stage of expansion, the cutaneous coverage of the prosthesis becomes too thin and fragile to protect the definitive implant (Fig. 31.4).

31.3 Preoperative Evaluation

The primary objective in breast reconstruction is to obtain symmetry [17, 18]. For this reason, it is essential to prepare a preoperative plan that includes a detailed analysis of the healthy breast's characteristics and the most suitable technique for treating this breast [19]. The aim is to obtain a breast with low projection in the upper pole, with no ptosis or tear shape. These characteristics are fundamental in order to achieve a successful reconstruction result (Fig. 31.5). Firstly, a clinical and radiologic preoperative evaluation is fundamental in order to properly choose the surgical technique. Secondly, apart from all the standardized examinations required in the anesthesiological preoperative appointment, it is also important that an oncologic evaluation be performed, surveying the following topics: type and size of tumor; number of positive lymph nodes; type of surgical procedure to be performed; chemotherapy, radiotherapy or hormone therapy procedures the patient is

Table 31.1 Indications and contraindications of delayed breast reconstruction with temporary expanders and implants

Indications	Contraindications
Patient preference	Previous radiotherapy
Good quality of skin	Previous failure of breast reconstruction with implants
Bilateral mastectomy	Morbid obesity
	Smokers

Fig. 31.3 Example of case with good local conditions for reconstruction with a tissue expansion device

Fig. 31.4 Example of case in which reconstruction with a temporary expander is contraindicated

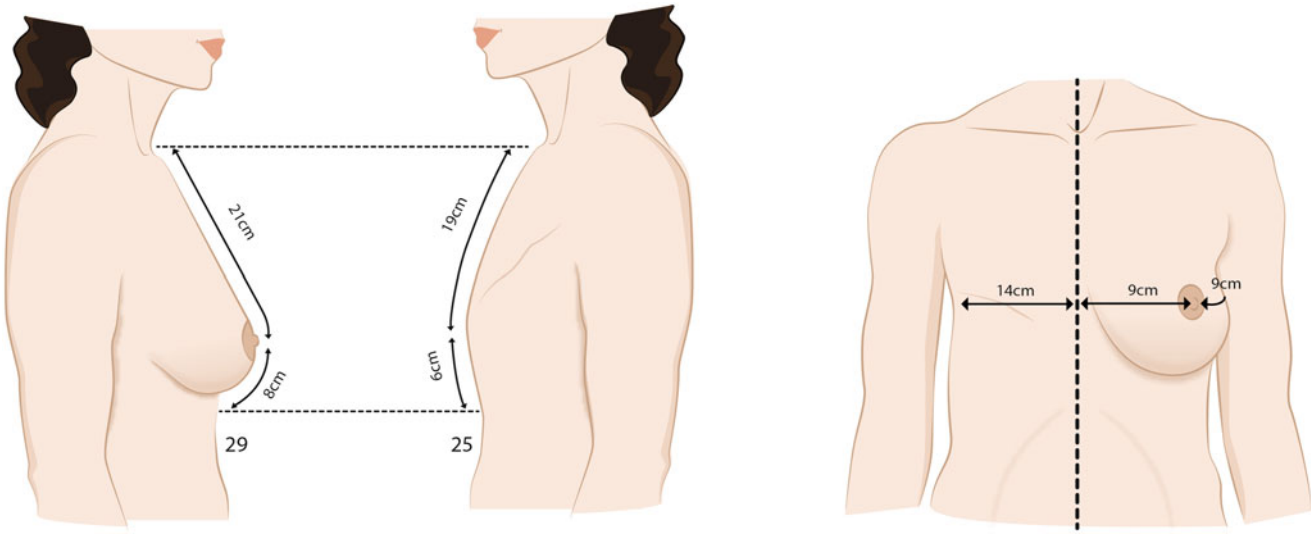

Fig. 31.5 Preoperative breast measurements

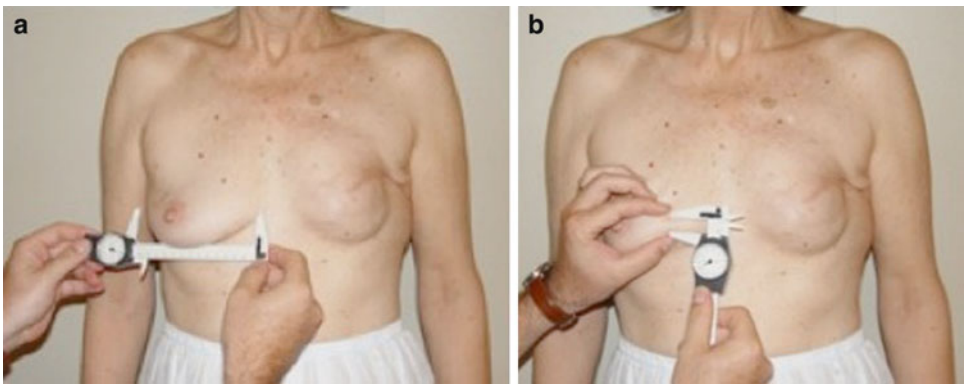

Fig. 31.6 **a** Example of taking the measurement of the base of contralateral breast for the choice of model and size of prosthesis to be used. **b** Example of "pinch" measurement, which gauges the thickness of the cutaneous and the subcutaneous tissue

adherent; follow-up period; and the most recently performed radiologic examinations and blood tests. Furthermore, the evaluation of the contralateral breast is also mandatory in order to exclude bilateral neoplasm and should include mammographic and ultrasound examinations. It should also be noted that contralateral breast surgery—a reductive mastoplasty, a mastopexy, or an additive mastoplasty—is frequently required to obtain a pleasing symmetry. Moreover, the contralateral breast evaluation should also aim to examine any palpable nodule or any mammographic alteration, such as microcalcifications or imaging patterns consistent with a suspicious lesion. Finally, it is important to state that no therapy of any sort is permitted prior to the surgical procedure itself aside from the prophylactic endovenous antibiotic administration of a first-generation or second-generation cephalosporin before skin incision.

31.4 Operative Outline

31.4.1 Before the Operation

Firstly, the preoperative outline is designed on the day before the operation and the whole of the procedure is explained to the patient again so that informed consent is obtained. The patient is then placed standing and photographs are taken of the patient in profile and in a forward-facing position. It is

Fig. 31.7 **a** Preoperative example of placement of a cutaneous incision into the pectoralis major muscle in order to achieve better protection of the prosthesis coating after suturing. A left augmentation mammoplasty procedure with a periareolar incision was also planned. **b** Frontal image and **c** lateral image 3 months postoperatively

very useful to make precise measurements of the contralateral breast on this occasion, such as base width, thickness of subcutaneous adipose tissue, height, and anterior projection.

31.4.2 Choosing the Implant

To help decide which implant one should use, it is important to compare the contralateral breast with the future implant with regard to the parameters of base, height, and anterior projection. This is done during the preoperative period in order to choose two or three models and sizes of implants that are most likely to be used during the surgical procedure (Fig. 31.6). The final decision can be made at the intraoperative stage, sometimes after the use of a sample. Surgeons should pay attention to whether the use of samples is prohibited in the country in which they work. In the European Union, for instance, the resterilization of samples is strictly forbidden. Nevertheless nonsterilized implants can be thoroughly coated with a highly adherent and resistant sterile plastic envelope, therefore permitting their repeated use. This technique for choosing the implants based on the aforementioned measures is much more precise and useful in cases in which it is necessary to use an expander and, subsequently, perform a contralateral augmentation mammoplasty. In cases that require breast augmentation surgery, we can use highly cohesive anatomic implants [20–22] or round implants. In cases of definitive implants with mastopexy or reductive mammoplasty of the contralateral breast, the decision as to the type and volume of the implant must also take into consideration the volume reduction, the change of shape, and the size reduction of the breast base. These calculations are based on augmentation mammoplasty articles [20, 23] which employed these methods to calculate the volume and shape of implants for esthetic improvement.

31.4.3 Surgical Markings

Afterwards, lines are drawn on the patient's chest to ensure the correct understanding of the anatomic condition. A median line should be drawn from the sternal notch to the xiphoid appendix, and the inframammary fold should be placed at the same height as for the contralateral breast. In the operating room, the patient is placed supine and with her arms parallel to her trunk. The operating table must be set in a way that the patient can be placed in a 90° position, i.e., sitting, at the end of the procedure.

31.4.4 Skin Incision and Scar Excision

The incision into which the implant will be inserted is made in the preceding mastectomy scar and, if possible, in the pectoralis major muscle. This technical detail allows a safer suture of the prosthetic pocket in two layers, namely, the muscular and the cutaneous layers. If a contralateral mammoplasty is required, the drawing is performed according to the technique chosen (Fig. 31.7). The skin incision with either partial or complete removal of the scar is chosen on the basis of three clinical situations:

1. *Wide scar with a great amount of skin*. An exeresis of the scar is located on the pectoralis muscle and it does not cause any technical problem when inserting the definitive prosthesis or the expander.
2. *Narrow scar with little skin*. The decision whether to remove the scar must be discussed with the patient, because it might change the intraoperative indication for a definitive prosthesis or for an expansion device.
3. *Wide scars without much skin when it has already been decided to use an expander*. The scar can be removed completely or almost completely but extra care must be

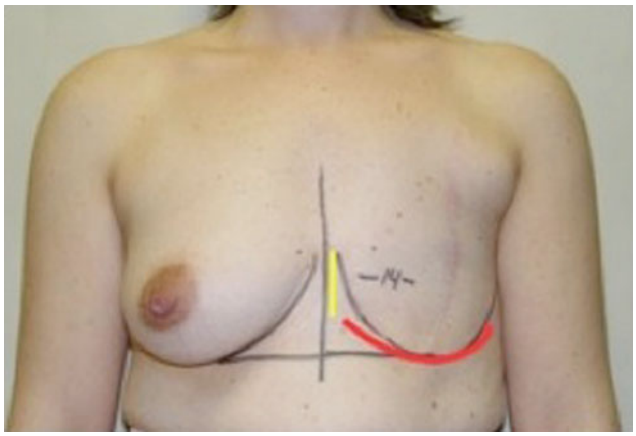

Fig. 31.8 Example of preoperative drawings with medial delimitation of the detachment of muscular fibers of the pectoralis major muscle; the aponeurosis of the left rectus abdominis muscle will be inferiorly sectioned and the superficial aponeurosis will be laterally sectioned

taken when expansion is performed, as a too sudden distension could widen the scar again.

31.4.5 Operative Technique

After the skin has been incised, an inferior lateral subcutaneous undermining must be performed from this region to the contour of the inframammary fold. This is required in order to set the prosthetic pocket, which can be located subcutaneously in this region or under the serratus muscle, in case the skin or the adipose subcutaneous tissue in the inferior lateral region is too fragile. As a result of this maneuver, one can see the lateral edge of the pectoralis major muscle, which is then lifted to set the submuscular pocket. This pocket can be made via a digital undermining in the upper portion, where no perforating vessels are found. In the inferior medial region, a light retractor is required so that efficient hemostasis of large internal mammary pedicles found in this region is performed. The pectoralis major muscle must then be completely detached from the costal surgical plan about 4 or 5 cm above the medial extremity of the inframammary fold. This dissection procedure is mandatory so that a nonesthetic movement of the implant can be prevented when the pectoralis major muscle contracts (Fig. 31.8). Preparation of the inframammary fold demands great technical attention, as it is an anatomic landmark crucial to the long-term esthetic result [5]. There are two possible variants:

1. *Without an upper abdominal skin flap*. This is used in cases when there is great elasticity of the skin, which allows the insertion of a definitive prosthesis or, if a decision has been made for a reconstruction in two surgical steps, with an expander. In such cases, the subpectoral dissection must reach no more than the inframammary fold level, and then an incision into the aponeurosis of the rectus abdominis muscle must be performed to achieve a better projection of the lower mammary pole. There is no need for an undermining maneuver lower than the projection of the inframammary fold, otherwise the prosthesis might end up being placed below the inframammary sulcus, consequently producing asymmetry.
2. *Using an upper abdominal skin flap*. This autologous tissue reconstruction technique mentioned at the beginning of the chapter is recommended for those patients in which a definitive implant is applied and the skin flaps from a mastectomy are not very elastic. An aponeurosis of the rectus abdominis muscle can be used if there is good elasticity of the skin in the upper abdominal area (just below the inframammary fold). The subpectoral dissection must reach the inframammary fold level, followed by incision of the undermining of the supra-aponeurotic region 2–3 cm below the inframammary fold. A cutaneous advancement flap can be easily performed if the patient is placed in a semisitting position. The inframammary fold is reconstructed with spread stitches of nonabsorbable thread, suturing the superficial aponeurosis at the upper limit of the aponeurosis of the rectus abdominis muscle medially and laterally at the serratus muscle (Fig. 31.9).

Fig. 31.9 **a** Preoperative example in which an abdominal cutaneous flap is planned to be used in order to improve the shape of the reconstructed breast. **b** Frontal image and **c** lateral image 3 months postoperatively

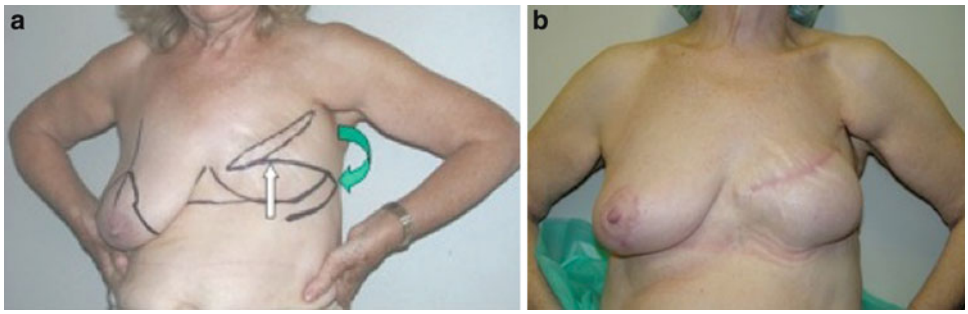

Fig. 31.10 **a** Preoperative drawings of Holmstrom's fasciocutaneous flap. **b** Frontal image 3 months postoperatively

31.4.6 Insertion of a Definitive Implant or a Tissue Expander

After the prosthetic pocket is set up, internal irrigation is performed with either pure saline solution or with saline solution containing an antiseptic. At this point, rigorous skin cleaning and change of gloves by the whole team before contact with the implant is mandatory. Such care helps to reduce the risk of microcontamination of the implants and therefore reduces the risk of postoperative infection or the formation and development of a periprosthetic capsule [24]. The implant, i.e., either the definitive implant or the expansion device, is carefully inserted into the prosthetic pocket.

31.4.7 Sutures and Closure

Finally, a tubular multiperforated aspirating drain is inserted into the prosthetic pocket as a safety measure. Then, suture is done in two planes. The first suture is done with the external edge of the pectoralis major muscle in the subcutaneous tissue with absorbable 3-0 monofilament stitches, and the second suture is an intradermal cutaneous suture with absorbable 4-0 monofilaments.

31.4.8 After the Operation

Some surgeons apply a dressing with elastic straps, causing a moderate compression for 3 days. Others choose a lighter dressing with no compression and also advise the patient to wear a sports bra (medium compression) immediately on the first postoperative day. This second option allows easier control of a possible postoperative hematoma and avoids risks of allergy and cutaneous lesions that might occur when adhesive elastic straps are used. The drain is removed when the drained fluid is serous and its volume is less than 50 mL in the previous 24 h. If a tissue expansion device is used, expansion with a variable volume of saline solution is usually recommended every 3 weeks. The correctly instilled volume should not cause tightness or erythema, or disrupt the patient's comfort or skin quality. As the aim of the expansion is to surpass the quality of a one-stage definitive implant reconstruction, augmentation of 25 % is needed to achieve this purpose, with ideal skin drape and recoil [5].

31.5 Association with a Fasciocutaneous Thoracodorsal Flap

This technique was initially described by Holmstrom (Fig. 31.10), who advocates the use of a rotational fasciocutaneous thoracic dorsal flap to improve the projection of the lower pole of the reconstructed breast. This technique can be applied in the case of an oblique mastectomy scar and the graft must be grounded on epigastric vascular pedicles, which cross the anterior aponeurosis of the rectus abdominis muscle. The flap must be designed with two-thirds of the base above the future inframammary fold and one-third below. After the preparation of the fasciocutaneous flap, an upper rotation of the flap is performed and the donor zone is covered with the inferior rotation of the lateral triangular flap together with the advancing of the upper abdominal skin flap. The implant is inserted below the pectoralis major muscle in the upper internal region and below the flap in the inferior lateral region (Fig. 31.10). This technique is not routine owing to the vascular fragility of the flap. It can be used when applying more complex techniques such as when the latissimus dorsi or the transverse rectus abdominis myocutaneous flaps are contraindicated.

31.6 Complications

Complications related to breast reconstruction with any type of implant can be classified into immediate (until 2 months after the surgery) or secondary (after the aforementioned period) [5]. The most frequent complications comprise hematomas, seromas, infection, and capsular contracture—discussed in other chapters in this book. Capsular contracture rates may be lessened by the use of implants with a textured shell rather than a smooth shell, by placement of the implant in a submuscular rather than a subcutaneous location, and by avoiding use of this technique in women

who need radiotherapy [16, 25]. Studies claim obesity, age older than 65 years, smoking, and hypertension are risk factors for complications following tissue expander reconstructions, smoking status, obesity, and hypertension (but not older age) also being predictive of surgical failure [26]. Obesity is also a risk factor in the situation of a definitive implant reconstruction [8].

31.7 Conclusions

Delayed breast reconstruction with implants can achieve satisfactory cosmetic outcomes and low morbidity. It is a surgical procedure that has minor risks, and in many cases can be performed as day surgery. Overall, this is the most used technique owing to its practicability, lower risk of complications than musculocutaneous flaps, and satisfactory esthetic outcomes with the various anatomic implants available nowadays.

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