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ORIGINAL ARTICLE

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Dual-plane implant positioning for capsular contracture of the breast in combination with mastopexy

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Abstract *Objective*: This study aims at combined surgical therapy options concerning patients with a clinically relevant and long-established capsular contracture following subglandular breast augmentation in a glandular ptotic breast. *Methods*: This is a review of 23 patients with capsular contracture. Three patients had a revision surgery for capsular contracture and implant dislocation before. The mean implant duration in the case of the twenty patients without any previous revision was 96 months. A revision implant has been re-located in a dual-plane position and further corrective surgery was carried out to adapt the glandular ptotic breast. Between 2001 and 2003, a chart review was performed on all patients for capsular contracture and ptotic breast by using the technique presented in this study. *Results*: In each case, the operation was performed as a one-stage procedure. The procedure included the following steps: Removal of the implant and total capsulectomy, preparation of an inferior de-epithelialised skin pedicle above the inframammary crease, release of the inferior origins of the pectoralis major muscle, creation of a new implant pocket by continuous connection of the inferior muscle border with the cranial edge of the inferior skin pedicle (dual-plane), adaptation of the soft-tissue/skin envelope by closing the cranial V over the implant coverage, preservation of the areola by creating a cranial or cranial medial pedicle. There was a follow-up for a period of up to 48 months, and any complication that occurred was documented. At follow-up period, all patients who had been implanted with a new implant pocket were free of a clinically relevant capsular contracture. *Conclusions*: In the cases of a severe capsular contracture and glandular-ptotic breasts, we presented the surgical corrections of the parenchyma/skin envelop as a one-stage procedure following the establishment of a new implant pocket.

Keywords Breast implants · Capsular contracture · Dual-plane positioning · Revision surgery

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Introduction

Capsular contracture accompanying prosthetic mammary augmentation and breast reconstruction continues to be the major drawback in an otherwise simple and safe operation [1–4]. Two studies have addressed the relative benefits of operation techniques and implant pocket location with respect to capsular contracture rates [5, 6]. The introduction of surface texturing and submuscular implant placement has reduced the rate of contracture in the short term [5–9]. There is still little known about the etiology of capsular contracture and the mechanism of texturing or subglandular placement in reducing its incidence [10–15]. Recently, encouraging results have been reported in the cases of submuscular and dual-plane implant positioning for primary surgery and, in particular, in cases of revision surgery for capsular contracture [16–18].

This article describes our experience with a revision augmentation technique that allows the development of a second implant pocket (dual-plane) that ensures sufficient soft-tissue coverage of the replacement implant. This technique also provides opportunities for combined procedures, such as mastopexy, in patients with capsular contracture and ptotic breasts following subglandular augmentation. In the cases of thin soft tissues surrounding the implant, the subtotal submuscular implant plane provides the necessary additional soft tissue. Changing the implant plane from a subglandular to a submuscular position is often accompanied by a discrepancy between the feasible breast volume and the

overlying soft tissue and skin. In particular, with implant conversion to a dual-plane positioning, both the highly mobile parenchymal breast and the glandular ptotic breast require an additional corrective surgery [16, 17]. The presented technique allows the maintenance of the former implant size and the adaptive reduction of the skin envelope in a one-stage procedure. In our experience, this technique prevents the risk of a ''double-bubble'' deformity that usually results from the parenchymal sliding inferiorly off the pectoralis following the change into a submuscular implant pocket [16]. The suturing of the superior edge of the de-epithelialised inferior skin pedicle to the inferior border of the pectoralis provides, in continuity, an additional dermal/subcutaneous layer of coverage in the lower pole of the breast where stretch and thinning are most prominent. In this study, we were not able to register muscular dysfunction. The follow-up period of these patients was up to 48 months.

Patients and methods

This study concerns 23 patients who, between 2001 and 2003, were treated at the Department of Obstetrics and Gynecology of the University of Aachen for the capsular contracture of breast implants. Only those patients who were operated for capsular contracture levels III or IV on the Baker score were included in the study. All the patients had undergone subglandular augmentation for cosmetic reasons. The patients enrolled in this study had a supplementary parenchymal ptosis of the tissue envelope of varying degrees. The data that was compiled regarding the primary augmentation included the surgical approach, the shell type of the implant, the implant localisation, the length of the operation, the implant duration and the volume of the primary implant.

The follow-up period was up to 48 months and all the complications that ensued were documented. With the replacement surgery, 14 patients received the same size of implant as the primary implant while nine patients wished to have smaller implants. In each case, the operation was performed as a one-stage procedure.

The degrees of the capsular contracture were defined according to the Baker-Score as follows [19]:

Grade I: Normally soft and natural appearance
Grade II: A natural appearance despite palpable firmness
Grade III: Firm with visible distortion
Grade IV: Obvious spherical distortion.

Surgical procedure

The surgical planning focused on the implant revision, skin and soft-tissue correction for additional mastopexy, scar length and placement, and nipple–areola position after upward mobilisation. The day before the operation, incision margins and the mid-breast line were marked, with the patient in a sitting or in an upright position with her arms comfortably at her sides. First the upper V was marked, limiting the angle of the V to the width of the areola. The highest point of the upper V marked the future position of the upper part of the areola in the projection of the inframammary crease at the mid-breast line or approximately 19 to 21 cm from the sternal notch. The inframammary crease was marked medially and laterally as short as possible with the weight off the breast. The medial and lateral lines were marked connecting the inferior points of the V to the medial and lateral junctures of the inframammary crease. The inframammary crease lines were re-marked with the patient supine. A second line with a distance of 4 to 5 cm to the inframammary crease had to be drawn to mark the area to be de-epithelialised (Fig. 1).

All patients received perioperative antibiotics, usually a cephalosporin. The operation was performed on both sides simultaneously. We found it easier to obtain symmetry by adjusting both breasts at the same time, rather than complete and close one breast. At the beginning of the operation, incisions were made around the areola line and the upper V was de-epithelialised when the preservation of a superior pedicle for the areola was planned (Figs. 1, 2). The marked skin area above the entire width of the marked inframammary crease had to be de-epithelialised to an extent of 4 to 5 cm in the direction at the areola in order to create the pedicle as a connecting piece for the pectoralis major muscle. The cranial tissue had to be separated from the skin-pedicle. Finally the pedicle had a height of 4–6 cm (Fig. 2). At the back of this pedicle, the breast parenchyma was resected in the direction of the pectoralis major muscle, leaving the pedicle with a thickness of 1.5 to 2 cm (Fig. 3). The implant and the implant capsule could then be removed by a direct approach. We performed a total capsulectomy. The ensuing release of the pectoralis major muscle along its lower border had to be extended as far medially as the space created by the capsulectomy and the implant removal (Fig. 4a, b). The release of the pectoralis major muscle along the sternal border and the progressive separation of the muscle from the chest wall in cranial direction had to be done restrictively in order to prevent unnatural superior and medial breast fullness and visible implant edges. While joining the submuscular pocket to the space created by the removal of implant and capsule, the pectoralis major muscle had to be removed completely from the pectoralis minor and the serratus anterior muscle. The new implant was now placed underneath the pectoralis major muscle and the pocket was closed with temporary sutures connecting the former inferior origin of the pectoralis major muscle to the superior edge of the de-epithelialised skin pedicle (Fig. 5a, b). Both structures can be adapted to find an optimal pocket size and to prevent implant sliding. The closure of excessive space medially, inferiorly or laterally might be necessary when the patients desire smaller breast implants. The apparent

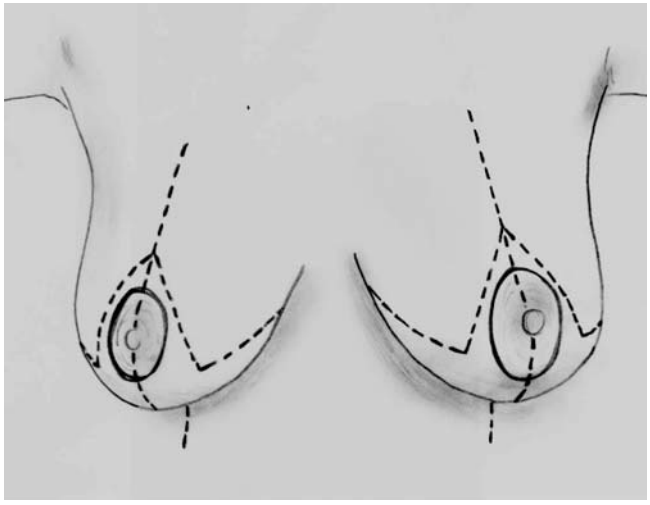

Fig. 1 Surgical planning. Patient with a capsular contracture following subglandular augmentation and a glandular ptotic breast. Operation incision margins (*interrupted lines*) are marked in an upright position. First, the breast-midline has to be drawn. The highest point of the upper V marks the future position of the areola. The medial and lateral lines connect the inferior points of the upper V to the medial and lateral junctures of the inframammary crease. The inferior skin pedicle will be prepared from the lower skin portion of the breast

excess space was closed with internal sutures. Finally, the implant pocket was closed completely. If a lateral gap occurs in the implant coverage, it can be filled with the pectoralis minor or serratus anterior muscle. The new implant is then within the pocket that consists of a subpectoral plane in the superior two-thirds and a skin/soft-tissue plane in the lower third. Now the upper V was prepared for closure. Before the nipple–areola was moved upward to its new position, the mobility of the tissue was checked. In cases of good mobility, we used the superior pedicle technique. In other cases, a full-

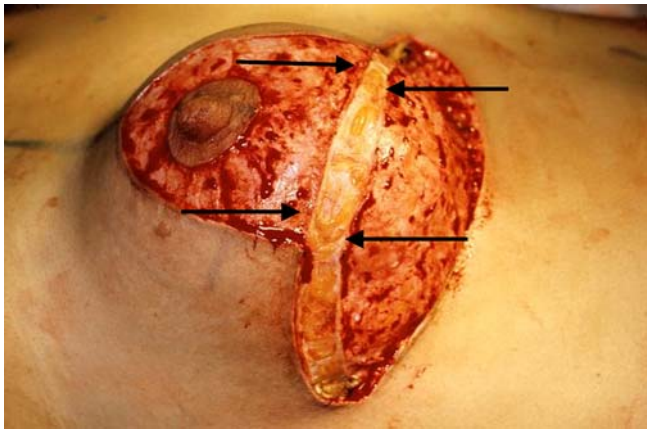

Fig. 2 Incision along the preoperative markings, the area included by the upper V and the future inferior skin pedicle is de-epithelialised. The cranial margin of the inferior skin pedicle is incised (*arrows from right*). The basis of the upper V is defined (*arrows from left*)

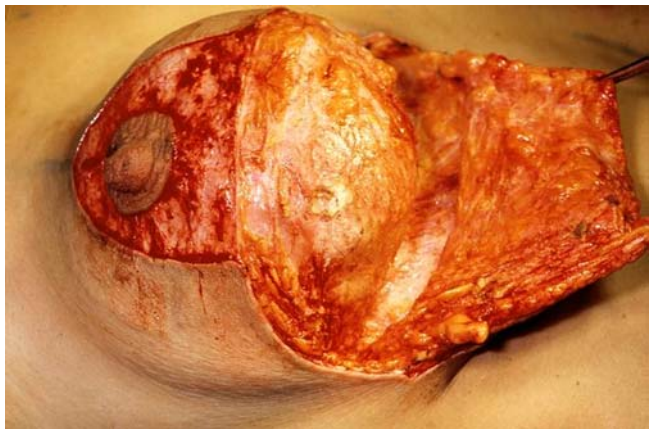

Fig. 3 The inferior skin pedicle is prepared with a thickness of 1.5 cm to 2 cm until the chest wall. The pectoralis major muscle is uncovered in the inferior portion. The inferior skin/soft-tissue pedicle is pulled in the inferior direction. The implant is in situ

thickness cut was performed through the breast parenchyma laterally within the V to create a superior medial pedicle. If necessary, a cut of 1 or 2 cm was made on the medial portion of the V upwards from the lower edge of

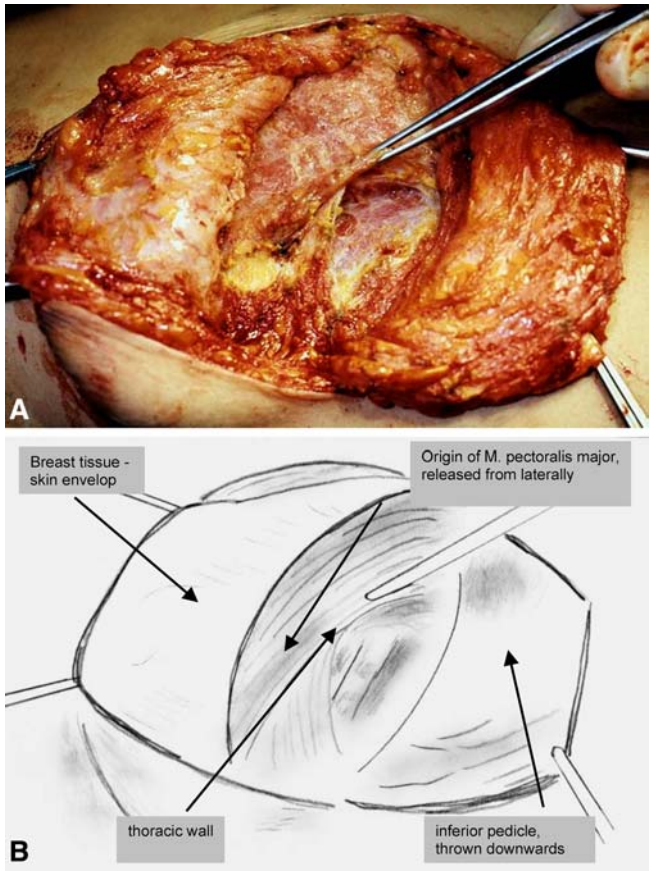

Fig. 4 **a** and **b** Implant and capsule are removed completely. The inferior origins of the pectoralis major muscle are identified at the chest wall. Release of the inferior origin of the muscle. Breast tissue-skin envelope is thrown upwards

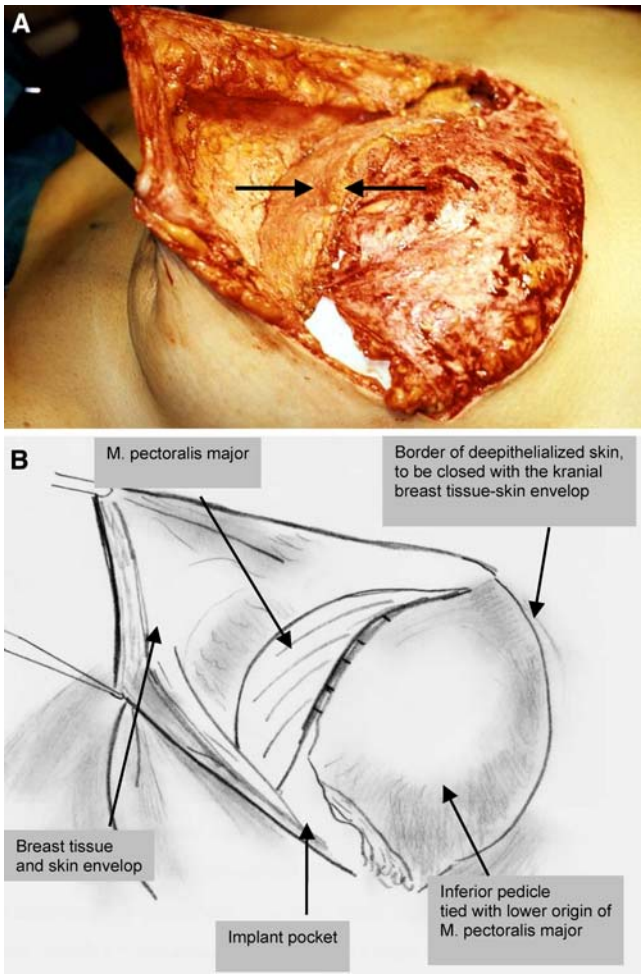

Fig. 5 **a** and **b** Temporary closure of the pectoralis major muscle (*left arrow*) and the inferior skin/soft-tissue pedicle (*right arrow*) after preparation of the implant pocket using an implant sizer. The breast tissue-skin envelope (thrown upwards) will ultimately be connected to the inferior border of the de-epithelialised skin

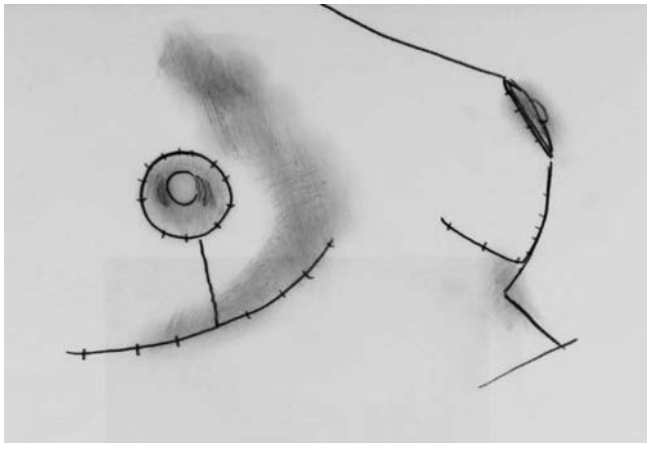

Fig. 6 The cranial skin/soft-tissue envelope is closed over the new implant pocket with a temporary T closure. The areola was moved upwards by a superior pedicle technique

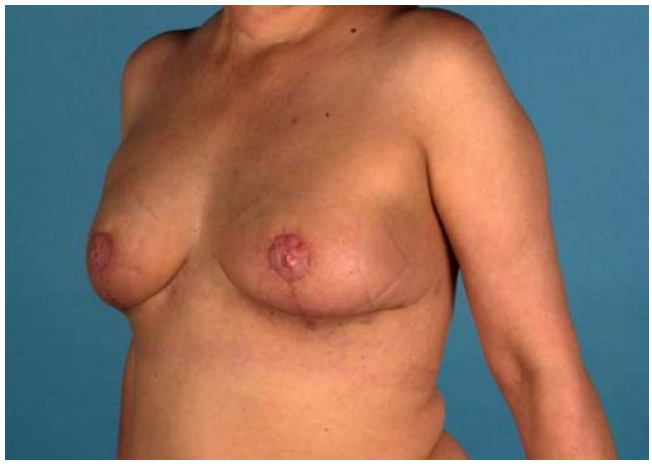

Fig. 7 Patient D.K. nearly three months after replacement surgery for capsular contracture Baker IV and glandular ptotic breast

the V to enhance pedicle transposition. We used a free nipple graft in the cases in which the nipple–areola needed to be moved a greater distance upwards than allowed by one of the superior pedicle techniques. The breast was now narrowed and reduced to its final size and shape by a temporary closing of the edge of the V with clips. Excess skin was resected medially for a gentle skin closure without tension. The cranial skin/soft-tissue envelope could now be closed over the new implant pocket with a temporary skin T closure (Fig. 6). The nipple–areola recipient site was excised full thickness. With the nipple rotated and elevated to its new position, the incisions were closed from lateral to medial towards the centre T. Closure was effected with intracuticular sutures and the surgical clips were removed (Final appearance see Fig. 7).

Results

A total of 23 patients underwent bilateral revision augmentation and a mastopexy for capsular contracture Baker III or IV following subglandular augmentation for cosmetic reasons. Three patients (13%) had undergone one prior revision, two of these revisions were due to capsular contracture and one for re-positioning the implant. For the former revision augmentations, the established subglandular implant pocket was used. These patients did not have any additional corrective surgery procedures administered during first revision. The remaining patients had no prior implant-related revisions. All the patients had at least two indications for revision. The indications were a combination of a capsular contracture of a differing degree in every patient (Baker III in 43%, Baker IV in 57%) with breast ptosis (57%), contracture-associated mal-positioning of the implant (21%) and dissatisfaction with the breast appearance (21%) (Table 1). At the time of revision surgery, 14 patients (61%) received the same implant volume. Nine patients (39%) desired smaller implants:

Table 1 Combined indications for revision augmentation

Indication	Number of patients	Percent
Capsular contracture Baker III	10	43
Capsular contracture Baker IV	13	57
Malposition of the implant	5	21
Breast ptosis	13	57
Dissatisfaction with the breast appearance	5	21

seven were suffering from breast ptosis and two were dissatisfied with the appearance of the breast.

No patient received larger implants. The average age of patients for revision surgery was 51 years (ranging from 34 to 67 years). The average implant duration of the 20 patients without prior surgery was 96 months. In the cases of a second revision, the average duration of the current implant was 22 months. We removed ten saline-filled implants (43.5%), ten silicone implants with a smooth surface (43.5%) and three textured silicone implants (13%) (Table 2).

The surgical procedure performed for revision included the exchange of the implant, a change of position of the implant to a dual-plane position, a total capsulectomy and a mastopexy with a superior or a medial-superior pedicle for the areola, except for two cases of free nipple–areola graft. All patients received a contemporary textured silicone implant. Eight patients (35%) had a scar revision. The mean operation time for all patients was 115 min, with the operation being performed on both sides simultaneously. Adjustable straps and bandages were used postoperatively to prevent upward or lateral migration of the implants. Every operation was done on an in-patient basis, the average duration of the hospital stay being 4.5 days. We advised the patients to return to full normal activity immediately, but to limit sport activities for 4 weeks.

The average time for follow-up after pocket conversion and corrective surgery was 24 months. The maximum follow-up for the first patients in this study was 48 months. To date, all the patients are satisfied with the appearance of their breasts and with the elimination of the implant-related symptoms. The few complications that have occurred could be corrected without re-operation. In two cases, there was a slight hematoma in the former implant plane. This has been managed without operation. A malpositioning in one patient, consisting in lateral sliding of the implant, could be cured by taping. All patients suffered a medium to strong pain in the short term. An analgesics therapy with NSAID (ibuprofen up to 800 mg/8 h or Diclofenac up to 50 mg/8 h) was administered to each patient for the first three days after the operation. An additional analgesic drug was necessary in four patients (17%) (e.g. metamicol). Prolonged pain symptoms occurred in three patients (13%) for a period of up to 3 months. During the period of follow-up, we did not register any muscular dysfunction resulting from the conversion of the origin of the pectoralis major muscle to its new position. All the patients who were converted to a dual-plane position were free of any clinically relevant capsular contracture at follow-up. Twenty-one patients (91%), when questioned later about their satisfaction with the operation, stated that they would opt for this procedure again. Two patients (9%) stated that they had a reduced quality of life because of prolonged pain that persisted for 3 months depending on the position of the body. Figure 5 gives an example of a patient nearly three months after replacement surgery for capsular contracture Baker IV and glandular ptotic breast. We used McGhan cohesive silicone gel implants for dual-plane positioning and included the adaptation of the soft-tissue envelope.

Table 2 Implant duration for conversion to dual-plane positioning

Type of implant	No. of patients	Percent	Duration in months
Saline-filled implants	10	43.5	126
Silicone implants, smooth surface	10	43.5	105
Silicone implants, textured surface	3	13	66

Discussion

The development of a capsular contracture around silicone breast implants continues to be the major complication of breast implants in the long-term [20–22]. Earlier efforts at the correction of encapsulated subglandular implants with closed capsulectomy, open capsulectomy and total capsulectomy with subglandular replacement of the revision implant were only partially successful, resulting in disappointing incidences of contracture recurrence [23]. The subpectoral placement of breast prosthesis is one of the methods put forward to decrease the incidence of capsular contracture [5]. However, when the pectoralis major muscle origin is repaired or left intact in primary or secondary augmentation, the available space for the implant is markedly reduced [16]. We report a series of patients suffering from a combination of capsular contracture following subglandular augmentation and glandular ptotic breasts. The presented technique considers the fact that breast tissue ages with time, becomes thinner and more compliant, resulting in envelope stretch even without the additional weight of the breast implant [3]. The ''dual-plane'' augmentation is defined as a localisation of the implant partially behind the pectoralis major muscle and partially behind the breast parenchyma (in dual planes simultaneously). This modification of the tissue layers in contact with the implant is intended to improve the implant-soft tissue dynamic to achieve better long-term results concerning both the glandular ptosis and the capsular contracture [16]. Our experience shows that controlling the implant-soft tissue dynamics in both the short and long term is the key to optimal long-term results. Recent studies reporting experiences of the dual-plane positioning of revision implants in the cases of

capsular contracture confirm that subpectoral positioning can be successful in achieving excellent aesthetic results with a low risk of capsular contracture [21]. This is particularly noticeable in patients with an already established capsular contracture and who could, therefore, be considered to have a higher risk of developing contracture recurrence. In these studies, different types of implants were used for the revision, and the results showed equal success [18]. It made no difference to the outcome whether the silicone and saline implants were textured or smooth. [16, 17]. We used silicone-gel-filled implants manufactured by McGhan Medical (Inamed Corporation, Santa Barbara, CA, USA). The presented surgical technique is designed to overcome the difficulties in achieving a natural breast appearance and the limitations concerning the implant volume in revision surgery for capsular contracture. Furthermore, the described method is able to adequately provide soft tissue coverage for the revision implant and it prevents the cranial sliding of the prosthesis [17]. This means that a prosthesis of any size can be used. The patients in our study had a combination of clinically significant severe breast firmness and, in some cases, implant displacement with a glandular ptotic breast. This technique takes into consideration that in glandular ptotic breasts, the parenchymal attachments to the pectoralis are insufficient to prevent parenchymal sliding. To optimally correct the degree of glandular ptosis, the implant must adequately expand the pocket anteriorly to ensure an adequate projection and fixation of the implant [16]. Optimal correction of glandular ptosis with implants requires maximum contact of the anterior surface of the implant with the posterior surface of the pocket. We performed the dual-plane positioning by establishing an inferior skin-pedicle for the continuous fixation of the lower origins of the pectoralis major muscle towards a completely closed new implant pocket. This resulted in an optimal breast projection and implant fixation. In cases of an areola to inframammary crease distance of more than 7 cm, the procedure was combined with a mastopexy [17]. A problem arising from insufficient fixation of the released lower origins of the pectoralis major muscle is the proximal contraction of the muscle and a roll-over of the free portion of the muscle during introduction of the implant [24]. The continuous connection between the pectoralis major border and the inferior skin pedicle avoids this situation by stabilising the lower origin of the muscle over its entire breadth. Furthermore, a dual plane positioning can be realised for any desired implant volume and without any muscular dysfunction occurring. The pectoralis muscle no longer restricts optimal implant projection and the implant can then optimally expand the lower breast envelope for optimal correction, while reducing the possibility of the parenchyma sliding off the pectoralis muscle. Some of our patients were athletically active, but in the follow-up neither they, nor the other patients, reported functional disturbances. In contrast to other investigators, we had no cases of inferiorly displaced parenchyma or recurrence of capsular contracture. We think the prevention of a parenchyma sliding is a question of a homogeneous pressure in the implant pocket and an optimal adaptation of the soft tissue/skin envelope to the implant pocket. These conditions can be achieved with the presented technique. This technique, which works in the case of all patients, is straightforward, anatomic, precise and highly successful in correcting the capsular contracture in glandular ptotic breasts. Although this study is not randomised, cases were done with a prospective intent and were consecutive. The presented technique adds surgical options for a more predictable correction of ptotic breasts when revision surgery is indispensable because of capsular contracture. The disadvantages of this technique are the final T-scar, the incidence of medium to severe pain in the post-operative period, and the relatively long operating time. The technical trade-off and limitation of the dual-plane technique is that in glandular ptotic breasts, parenchyma may displace inferiorly despite achieving optimal contact between implant coverage and the soft-tissue envelope [16].

Conclusion

Clinically relevant capsular contracture can be reliably corrected by replacing the existing implants with a modern silicone gel implant, creating a dual-plane implant pocket and fixing the lower origin of the pectoralis major muscle to an inferior skin pedicle. This technique allows the surgeon to take advantage of an additional soft-tissue coverage by the pectoralis major muscle superiorly and a skin/soft-tissue pedicle in the inferior part of the implant. We have presented additional options for surgical corrections of the parenchyma/skin envelope after the removal of the contracted implant in the cases of glandular-ptotic breasts in a one-stage procedure. The position of the pectoralis major muscle and the parenchyma can be adapted to the desired volume of the implant by optimising the implant/soft-tissue dynamics.

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