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New surgical strategies in breast surgery

Problems and their possible solutions

Prognosis of breast cancer

As Buzdar et al. [4] reported at the ASCO (American Society of Clinical Oncology) Breast Cancer Symposium in 2010, an improvement in prognosis from 55% to 86.1% for local disease and from 16.2% to 74.1% for regional involvement has been achieved in the last six decades in the collective of 12,809 patients treated at the MD Anderson Cancer Center.

Whereas traditional concepts of determining prognosis were primarily based on tumor size and the lymph node status, nowadays tumor biology and also genetic signatures are regarded as the deciding factors.

According to Sorlie et al. [22], the following types have already been distinguished since 2001:

- Subclasses Luminal A, B, C,
- "normal breast-like,"
- "basal-like."

Breast cancer resulting from a *BRCA*-1 mutation or *BRCA*-2 mutation occurs in 3.4% and 1.7% of cases, respectively. Another 5% arise from mutations in other genes, such as *RAD51C* (also called the *BRCA*-3 gene), and another 10% are the result of the moderately penetrant mutation and some low-risk variants [16].

The other 80% of breast cancers are designated as "sporadic," which does not mean that they might not be associated with genetic changes in the future. However, other risk factors such as hormone intake, early menarche, late menopause, nulliparity, obesity, and nutritional habits of industrialized countries (such as a high-fat diet) also serve as favorable circumstances for the development of breast cancer.

Surgical therapy of breast cancer

From the "Rotter-Halsted dogma" of radical surgery to "targeted surgery"

Breast surgery can look back upon centuries of a development that initially only involved radical oncologic surgery of the mammary gland.

Cancer surgery experienced a successive change from surgical radicality to breast surgery adapted to the situation considering aspects of oncologic safety and taking into consideration tumor biology while simultaneously trying to achieve optimal aesthetics.

In this report, we focus on the development of the standard for breast surgery, the problems, and new solutions in surgical therapy.

Surgical techniques

Which surgical techniques are regarded as the standard nowadays?

The distribution pattern of breast cancer and its precursors is usually segmental.

Therefore, surgical therapy is also oriented toward segmental resection of the affected area.

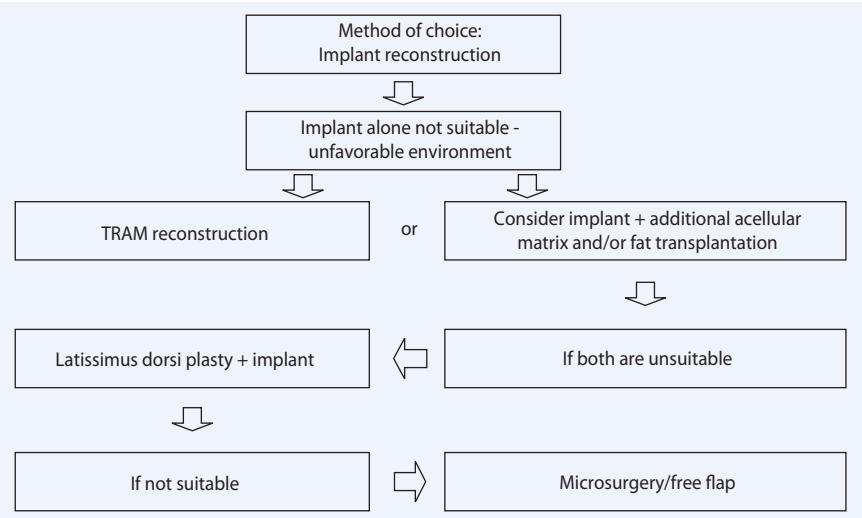

Fig. 1 ▲ AGO Guideline 2011: Algorithm for breast reconstruction – plastic-reconstructive aspects after mastectomy (Adapted according to [1])

Tab. 1 AGO Guideline 2011: Plastic reconstructive aspects after mastectomy. (Adapted according to [1])

Author, year, publication	Described cases	Partial skin necrosis	Local recurrence	Time interval
Lanitis S et al. 2010 Ann Surg [15]	1104 SSM 2635 NSSM		6.2% SSM 4.2% NSSM n.s.	1997-2009 Meta-analysis
Jensen JA 2010 Ann Surg Oncol [13]	99	6%	2.7%	Median follow-up period: 60.2 months
Yi M, Kronowitz SJ 2010 Cancer [28]	799 SSM 1011 CM		n.s. (local + systemic 6.6%)	2000-2005
Kim HJ 2010 Ann Surg [14]	368 SSM 152 NSSM	9.6% NAC	0.8% SSM 2.0% NSSM 1.3% NAC	7/2001-12/2006
Paepke S 2009 Ann Surg [17]	109 SSM (96 NSM)	1.0% nipple necrosis	No recurrence in the nipple	2003-2006
Chen CM 2009 PRS [6]	115 (62 benign)	NAC loss: 5.2% Occ.ca. 3.5% necrosis		1998-2008
Garwood ER 2009 Ann Surg [8]	170	Cohort 1: 16% Cohort 2: 11%	0.6%	2001-2007
Yano K et al. 2007 Breast Cancer [27]	128	3.1%	2.3%	2001-2005
Petit JY et al. 2006 Breast Cancer Res. Treat [19]	106 NSM	4.7% NAC loss	0.9% Far away from the NAC	2002-2003
Gerber B et al. 2003 Ann Surg [9]	112 (including 61 NSM)	0%	5.4%	1994-2000

SSM skin-sparing mastectomy, **NSSM** non-skin-sparing mastectomy, **n.s.** not significant, **CM**, conventional mastectomy, **NAC**, nipple-areola complex, **NSM**, nipple-sparing mastectomy, **Occ.ca**. occult carcinoma (not visible at the time of the operation).

Tab. 2 Skin-sparing (SSM) and nipple-sparing mastectomies (NSM) – Complication rates with the use of titanized meshes (Ti-LOOP® bra). "Single institution experience" (Rezai et al. 2011)

Complications	n=49	%
Dysesthesias	10	20.3
Hematomas	5	10.2
Hemorrhages	4	8.2
Keloids	3	6.9
Fever	2	4.6
Suture dehiscence	2	4.6
Seromas	1	2.0
Implant rotations	0	0
Implant loss	0	0
Papillary necrosis	0	0
Infection	0	0

With increasing invasiveness, the surgical revision steps are differentiated as follows:

- Lumpectomy,
- Segmentectomy,
- Quadrantectomy,
- Hemimastectomy,
- Nipple-sparing mastectomy (NSM),
- Areola-sparing mastectomy (ASM),
- "Skin-sparing" mastectomy (SSM), and
- Modified radical mastectomy according to Patey.

The radicality of the surgeries has regressed more and more with respect to the breast as well as the axilla.

In the 70s, the Milan I study led to a paradigm shift when Veronesi et al. [23] randomized 701 patients each to two treatment arms: breast-sparing therapy (quadrantectomy, axillary dissection, radiotherapy) vs. Halsted mastectomy. The survival rates were identical; thus the radicality of the Halsted operation gave way to a multimodal concept with breast sparing [24].

Lymph node dissection at that time was initially intended for removal of all lymph nodes at the level defined by Berg [2]. Again it was Veronesi [25] who replaced this radical procedure by a new concept, in that he assumed an orderly lymph flow from solid tumors with tumor cell dissemination via the sentinel lymph nodes that drained first and whose involvement proved to be representative for the status of the entire axilla.

The cumulative incidence of axillary recurrences was low at 0.9% in the collective of "sentinel node"-negative patients, as he demonstrated in 2009 based on 3548 patients with a follow-up of up to eleven years and a median follow-up of up to four years [26].

›› The radicality of the surgeries has regressed more and more

At the ACOSOG (American College of Surgeons Oncology Group) Study Z0011, Guiliano et al. [11] demonstrated – in a favorable patient collective of primarily postmenopausal hormone receptor-positive women – that even with one or two positive lymph nodes, omitting axillary dissection did not lead to increased recurrence and mortality rates over a median follow-up time of approximately six years.

For mastectomy as well, a revised way of thinking has begun: According to Patani et al. [18], SSM for invasive breast cancer <5 cm, multicenter tumors, and ductal carcinoma in situ (DCIS) as well as prophylactic risk-reducing surgery has proved to be oncologically as safe as modified radical mastectomy itself.

The 2011 Breast Guideline of the Gynecologic Oncology Work Group (AGO; [1]) confirms this point of view in suitable selected patients – as well as for nipple-sparing mastectomy, for which no significantly higher local recurrence rate was found in a large meta-analysis by Lanitis [15] in observational studies (**Tab. 1**).

In plastic reconstructive breast surgery, implant-supported reconstruction takes first priority after a mastectomy because by way of comparison it can be performed with the fewest scars and least surgical effort, provides good aesthetic results, and is also reversible. After that – if it is unsuitable or the local status is impaired, e.g., by irradiation – autologous tissues or lipofilling or acellular dermis are used (**Fig. 1**).

New surgical methods

"Targeted breast surgery"

This new form of breast surgery also can be called "targeted,"

Infobox 1

With the development of a universal principle in reductionplasty, which was introduced in the early 90s (modified inferior technique according to Rezai), new opportunities opened up both in the area of aesthetic oncoplastic surgery and in the area of simultaneous reconstructive surgery such as subcutaneous (SCM) or skin-sparing mastectomy for ptotic breasts.

Infobox 2 Information on the topic

More information on the topic of this article such as breast reconstruction, new materials such as meshes, acellular dermis, lipofilling, and "live surgery" will be presented as part of the 9th Düsseldorf Breast Cancer Conference from 6/7 to 6/9/2012.

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as can systemic therapy with targeted substances, because it avoids unnecessary resections during simultaneous radical removal of the portions of the mammary gland regarded as oncologically relevant. The various surgical options, knowledge of tumor biology, and inhomogeneity of the patients make an individual, targeted therapeutic philosophy more necessary than ever.

Techniques of volume and skin reduction

Problem: Secondary ptosis, risk of nipple necrosis when there is a large distance between the jugulum and nipple.

Solution. Modified inferior technique with cranial, *corial* pedicle formation of the nipple-areola complex.

For the first time in 1992, we described a modified inferior reductionplasty technique as a universal method that has seen practically no limits in terms of indication and feasibility, and it subsequently continues to be further developed [20].

Whereas other techniques leave the nipple on a wide inferior pedicle, in the method we described, the pedicle formation of the nipple from a cranial aspect is of a *purely corial origin* during caudal, glandular flap formation with optimal reconstruction of the upper filling. The skin covering is placed over the modeled mammary gland body like an implant and is consolidated into the submammary fold. Finally, the localization for the nipple is established and cut out. The new inferior technique is increasingly becoming accepted ([3]; **Fig. 2, 3, 4**).

Mastopexy

Mastopexy is oriented toward the same technique as inferior reductionplasty but omits resection of the mammary gland volume. Overcorrection of the "upper filling" is deliberately undertaken because it takes into account the subsequent ptosis in the near future.

Abstract

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New surgical strategies in breast surgery. Problems and their possible solutions

Abstract
Breast cancer is still the most prevalent gynecological malignancy in Germany with 57,000 primary cases per year. Disease prognosis in industrial nations has improved in re-cent decades due to the introduction and op¬timization of systemic treatment, including targeted therapies. However, not only sys-temic treatment should be targeted: surgical strategies offering optimal oncological safety as well as excellent aesthetic results should be developed to protect patients' physical integrity and body image.

Keywords
Breast surgery • Immediate reconstruction • Skin-sparing mastectomy • Inferior technique • Meshes

Subcutaneous and skin-sparing mastectomy with simultaneous reconstruction

Fernández-Delgado et al. [7] analyzed patient satisfaction and the psychosocial status after breast reconstructions.

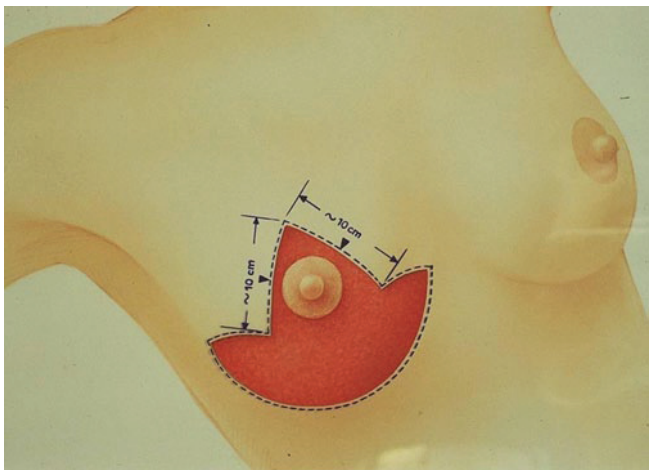

Fig. 2 ▲ Modified inferior technique according to Rezai: Deepithelialization figure

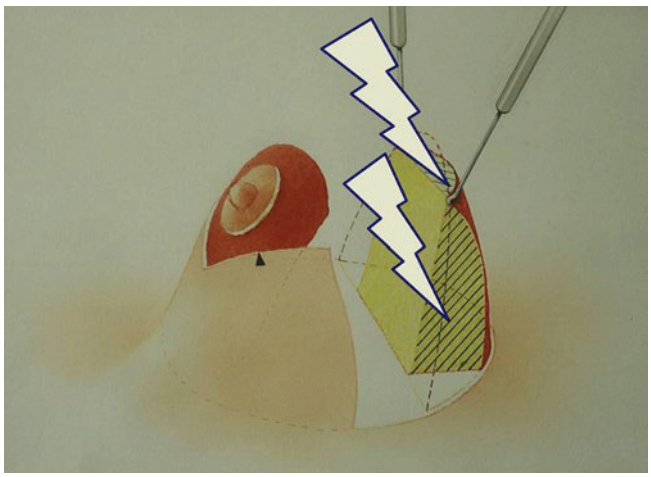

Fig. 3 ▲ Preparation of the mammary gland tissue during reductionplasty (according to Rezai). *Arrows* indicate the preparation in the case of formation of a "corial flap"

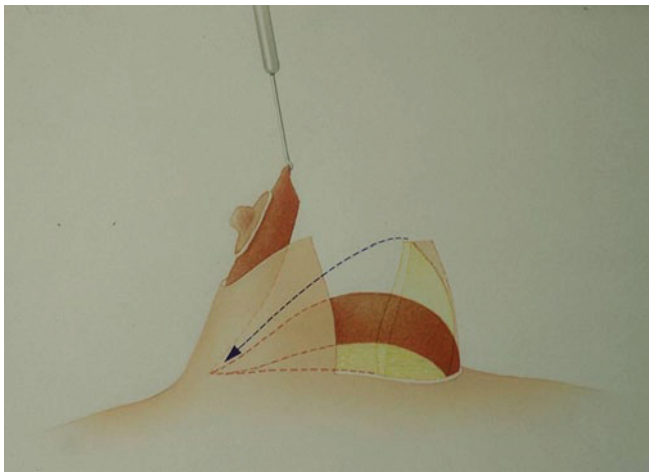

Fig. 4 ◀ Formation of the mammary gland body according to an implant as part of reductionplasty using the inferior technique according to Rezai

mastectomy and were categorized based on immediate reconstruction, secondary reconstruction, and no reconstruction. It turned out that the patients without breast reconstruction had more psychological problems (worry/anxiety in 24.6% and depression in 18.4%) than did women with immediate reconstruction (15% each for anxiety/worry and depression) or secondary reconstruction (14.6% anxiety/worry and 15.3% depression). Marked differences between the groups were also noted for satisfaction. Of the women with reconstruction, 63.49% were satisfied with the aesthetic result; of the women without reconstruction, only 22.80% were satisfied. Therefore, simultaneous reconstruction seems to play a not insignificant positive role in the psychological well-being of the patients (**Fig. 5**).

›› Simultaneous reconstruction plays a positive role for the psychological well-being

Problem: The caudal pole.

The caudal pole is the most common location for prosthesis dislocation and expulsion because the weight of the prosthesis experiences its maximum point here due to the force of gravity. Two shapes of the breast pose different challenges and also require different surgical procedures: the ptotic breast and the normal breast shape. The lower covering of the implant, above all, is constructed differently.

Solution. Pedicled local dermofat flap for the ptotic breast.

Not the unpedicled autologous dermal strip published by Hinderer [12] but rather the autologous local remaining lipocorial fat flat {LCF; **Fig. 6**) dissected from the glandular tissue gives the lower hemisphere of the breast the necessary counterbearing and prevents a "double bubble" phenomenon and prosthesis expulsion caused by simultaneous pressure transfer and rounding.

The concept of the "internal bra" that he described was further developed by the inferior technique reductionplasty method presented here by the author.

Problem. Lack of implant coverage and muscle retraction during reconstruction without prior ptosis or macromastia.

Solution. Use of heterologous materials [titanized mesh (e.g., TiLOOP® bra mesh implant; **Fig. 7**) or acellular matrix (e.g., Strattice™, reconstructive tissue matrix; **Fig. 8**)].

Creation of a muscle lodge after incision of the pectoralis major muscle at its caudal insertion point leads to muscle retraction, which leaves the implant uncovered in its inframamillary region. Here, titanized meshes, which do not cause rejection reactions, can also be used,

Fig. 5 ◀ Aesthetic outcome after subcutaneous mastectomy (SCM) with implant (CPG™, Style 312, Mentor®) and mesh reconstruction (TiLOOP®)

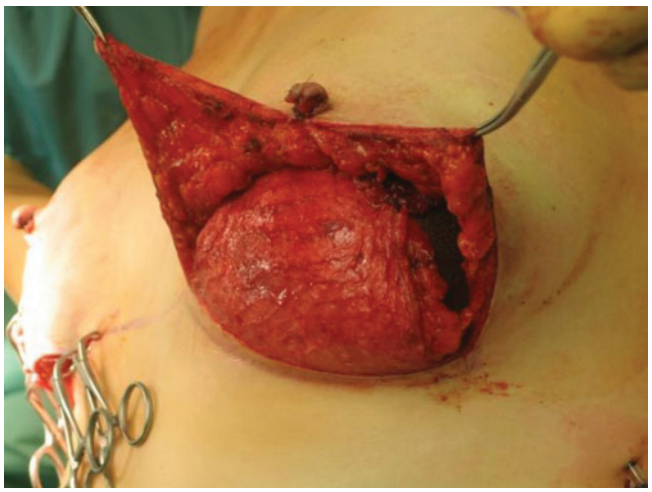

Fig. 6 ▲ Coverage of the caudal half of the implant by the lipocorial flap

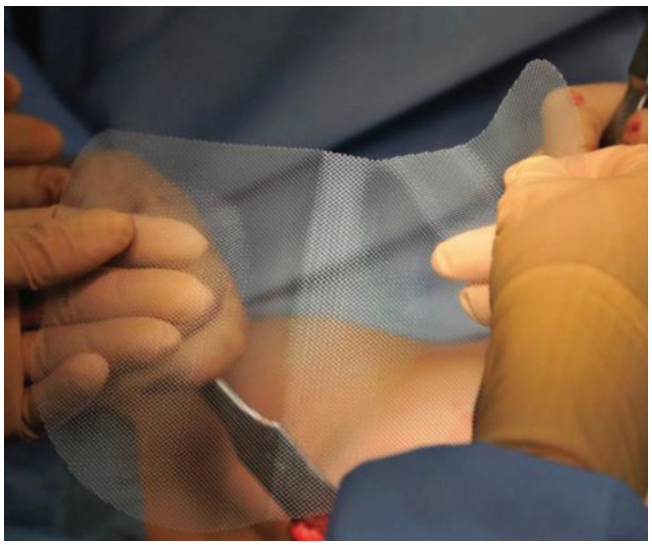

Fig. 7 ▲ Coverage of the caudal half of the implant using a titanized polypropylene mesh (e.g., TiLOOP® bra mesh implant)

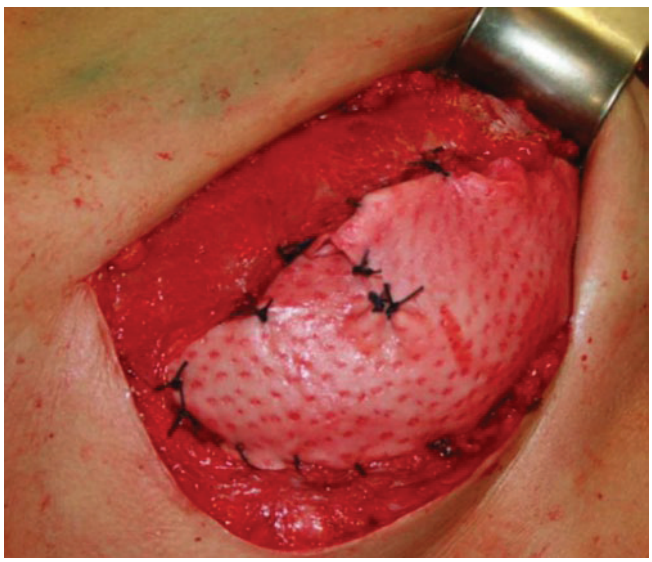

Fig. 8 ◀ Coverage of the caudal half of the implant using acellular matrix (e.g., Strattice®)

such as acellular matrix (e.g., porcine dermis), which is used when the skin is very thin.

We analyzed 161 SSM/NSM in a retrospective cohort analysis from our own patient collective. We presented the results for the first time at the "6th European Conference on Oncoplasty and Reconstructive Surgery of the Breast" (Milan, 12/14-17/2011). The objects of the investigation were the surgical results, patient satisfaction, and complication rates of SSM/NSM with immediate reconstruction – each with respect to the type of coverage for the caudal pole of the implant with "corial flap" (n=91) or titanized mesh (n=49). The complication rates were very low, and neither implant loss nor nipple necrosis were reported in the entire collective. In the follow-up period of up to three years, no local recurrences occurred.

In light of the current implant discussion, it should be noted that only implants by the company Mentor are used for implant reconstruction.

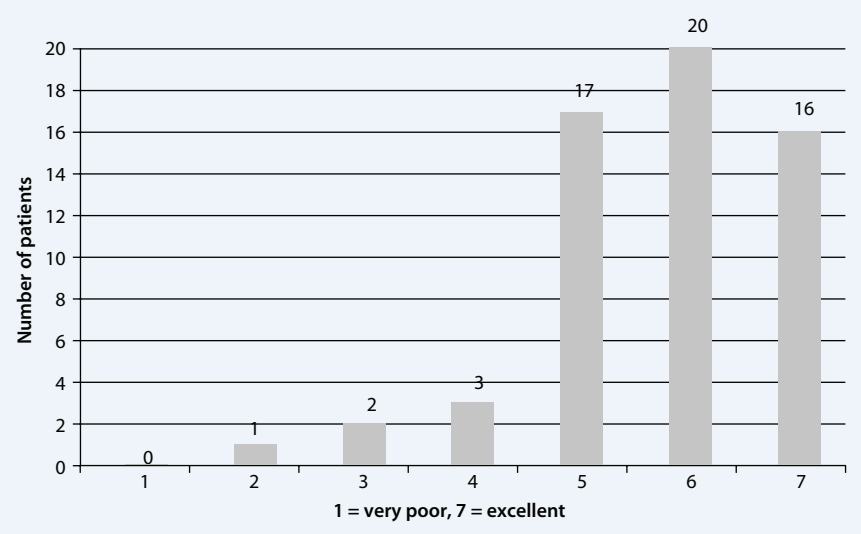

Fig. 9 ◀ Quality of life after skin-sparing (SSM) and nipple-sparing mastectomy (NSM) and simultaneous reconstruction (EORTC questionnaires C30 and BR23)

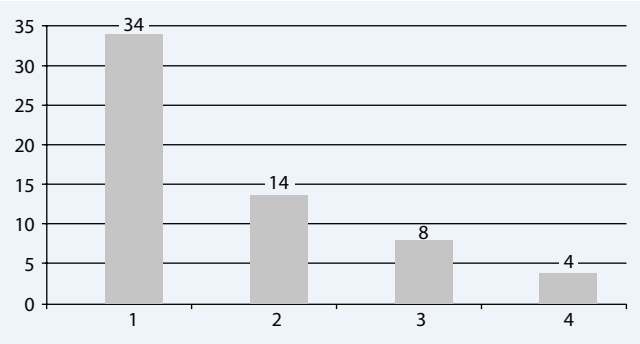

Fig. 10 ◀ Difficulties seeing oneself naked after breast reconstruction (1: no difficulties; 4: major difficulties)

For SSM/NSM and the use of titanized mesh, there were only low complication rates (◘ **Tab. 2**).

Breast reconstruction has a positive effect on the psychological well-being of the patients. After SSM/NSM and simultaneous reconstruction, the overwhelming majority do not have any difficulties seeing themselves naked according to validated questionnaires of the European Organisation for Research and Treatment of Cancer (EORTC; C30 and BR23) (◘ **Fig. 9, 10**).

Summary for clinical practice

Breast surgery has developed into an increasingly targeted therapy, making a transition from radicality with post-mastectomy trauma to aesthetic oncoplastic surgery and, in particular in the areas of oncoplasty and reconstruction, is setting new standards. The new surgical methods and materials described here should be part of a teachable and learnable concept in aesthetic surgery that ensures high patient satisfaction with simultaneous oncologic safety in an optimal ratio. Patients find the combination of simultaneous reconstruction with mastectomy as part of the same operation to be less inconvenient, and they achieve a good body image, which also has an effect on their interactions with their partners. New materials help in reconstructive breast surgery during shaping and can be used without major complications.

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Conflict of interests. The corresponding authors report that there are no conflicts of interest.

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