Treatment and Care of Scars in Breast Reconstruction

36

Christina Garusi and Visnu Lohsiriwat

36.1 Introduction

Immediate breast reconstruction or an oncoplastic technique has been widely performed as an integral step in breast cancer surgery [1, 2]. The contralateral breast can be operated on in a symmetrical procedure or in an exploration step for tissue diagnosis [3]. Besides general considerations and management of scar tissue, in breast cancer surgery one must also consider the location of the scar (breast or donor site of autologous tissue), the timing of the scar (immediate or delayed), adjuvant therapy given to the individual cancer patient (e.g., radiotherapy and chemotherapy), and cancer prognosis. In this chapter, we discuss the specific characteristics and problems of each scar. We mainly categorize scar regarding the location of the primary incision.

36.2 Location

Breast-related scars result from both ipsilateral and contralateral breast surgery. The contralateral scar pattern can be categorized the same as the ipsilateral one. The incisions which are frequently used can be divided into incisions related to breast conservative treatment (BCT) and total mastectomy.

36.2.1 Breast Conservative Treatment

36.2.1.1 Without Oncoplastic Technique

This refers to an incision which is used in general for tumorectomy, lumpectomy, or wide excision. Its location usually corresponds to the location and quadrant of primary tumor. The overlying skin may or may not be removes depending on the distance of the tumor from the skin and the technique used by the surgeon. The incision can be radial, curvilinear, or circumareolar. The incision should be placed with the respect to the aesthetic unit of the breast [4].

36.2.1.2 With Oncoplastic Technique

The incisions for BCT with an oncoplastic procedure usually resemble those of mastopexy or a breast-reduction procedure. The incisions most commonly used are a periareolar incision, a vertical incision, and an inverted-T incision.

Management of these scars usually depends on radiotherapy, which is almost always integrated in BCT. However, radiotherapy probably plays a positive role for scar remodeling and formation [5]. Despite the oncoplastic technique resulting in more scars, it produces more symmetry and a better aesthetic result for the patient. Moreover, if the incision for oncoplastic surgery is well planned, it can be hidden in a less visible area. Another special consideration of scar management for BCT is if there is scar contracture. This may lead to malpositioning of the nipple and an unpleasant configuration of the entire preserved breast. The contracture occurs especially from the scar tissue in the breast itself.

36.2.2 Total Mastectomy

36.2.2.1 Skin-Sparing Mastectomy

The incisions usually performed for skin-sparing mastectomy are an elliptical incision, a racquet incision, or a circumareolar incision. The breast mound is immediately reconstructed by an expander–prosthesis or an autogenous base. Scar from skin-sparing mastectomy can be revised

C. Garusi (✉)
Division of Plastic Surgery, European Institute of Oncology, Milan, Italy
e-mail: cristina.garusi@ieo.it

V. Lohsiriwat
Faculty of Medicine, Department of Surgery, Siriraj Hospital, Mahidol University, Bangkok, Thailand
e-mail: lohsiriwat@gmail.com

C. Urban and M. Rietjens (eds.), *Oncoplastic and Reconstructive Breast Surgery*,
DOI: 10.1007/978-88-470-2652-0_36, © Springer-Verlag Italia 2013

during the secondary procedure of nipple–areola complex (NAC) reconstruction.

36.2.2.2 Nipple-Sparing Mastectomy

The incisions which are recommended by European Institute of Oncology (EIO) are a superolateral radial incision, an inferolateral radial incision, a superior circumareolar incision, and periareolar incisions [6]. Regardless to the type of incision, the unique concern in this procedure is the location of the NAC. Scar from a radial incision can displace the NAC toward the vector of scar contracture.

36.2.2.3 Scar After Conventional Mastectomy or Delayed Mastectomy Scar

The scar from this category tends to have the poorest aesthetic outcome. The scar usually attaches to the chest wall and there is lack of adjacent healthy skin and subcutaneous tissue, especially after external radiotherapy.

36.2.3 NAC Area

We should pay special attention to the scar in NAC area because it can affect the final outcome of the reconstruction. The scar in this area may distort the disk-shaped areolar and nipple projection.

36.3 Method of Scar Improvement

36.3.1 Medical Ointment and Cream

Scar pruritus is common, especially in burn patients, and the reported incidence is between 25 and 100 % [7, 8]. Long-term scrubbing and rubbing lead to secondary skin lesions with additional release of inflammatory mediators that can aggravate the pruritus and cause abnormal scarring. Beside systemic administration of first-generation H1 antihistamine, encouraging results were obtained when targeting the central nervous system with systemically administered agents, including gabapentin, naltrexon, and ondansetron. Also topical administration of various substances has been reported to decrease itching sensation. Cooling, menthol, and icilin can relieve experimentally induced itching. A topical antihistamine agent such as doxepin was demonstrated to highly effective as an antipruritic cream in an itching wound. Capsaicin is a vanilloid which leads to depolarization and release of secretory granules which contain substance P or calcitonin gene related peptide. This action leads to desensitization of nerve fibers, inhibition of neuropeptide accumulation, and suppression of painful and itching sensation. Cannabinoids are known for their analgesic potency upon administration. A pilot trial with palmitoylethanolamine-containing cream should that it relieved pruritus in hemodialysis, prurigo nodularis, and lichen simplex.

Corticosteroids have been demonstrated to inhibit extracellular matrix production and deposition of excessive collagen. Moreover, the inflammatory response is suppressed by decreased proinflammatory cytokine production and inhibition of angiogenesis. However, treatment of hypertrophic scar with topical steroids failed to show any improvement in scar management.

A few studies on imiquimod, an immunomodulator, reported favorable results of keloid treatment after surgery. Long-term application is advised only 1 year after surgery.

36.3.2 Physical Treatment

Manual massage with or without cream is believed to have beneficial effects on scar, such as drainage of edema, reduction of pruritus, and skin moisturization [9–13]. The massage relaxing effect can result in improve tolerance of and compliance wit rehabilitation treatments. However, this technique should be performed with caution in immature and fragile scar. The friction from massaging can cause a painful, blistering skin effect, prolonged inflammation, and additional hypertrophic scarring.

Physiotherapy is considered a necessary part of the rehabilitation program especially with splinting and stretching. The principle of splinting is to maintain the normal range of motion especially when the scar crosses a joint. There are dynamic and static splints which can be used in different stages of scar treatment.

Shock wave therapy is an externally applied controlled regimen of mechanical force in the form of pressure disturbances. It has been shown to decrease fibroblast to myofibroblast transdifferentiation and also to break down overproduced collagen. Its use still lacks scientific support in clinical scar management. The contraindications include pregnancy, anticoagulant medication, varicose veins, and open wounds.

Thermal therapy with high-pressure water and air therapy are used in scar treatment. The combination effects of pressure and a thermal bath can improve the scar. However, it is recommended when the epidermis is strong enough and there is no infection or wound. Pain can be a side effect of using high-pressure water.

36.3.3 Pressure Garment

Pressure therapy is used mainly for treatment of hypertrophic scar s and keloids, especially after burn injury and prophylactically in wounds that take more than 14 days to heal spontaneously [14–16]. It is usually applied when the

wound is fully closed and the patient is able to tolerate the pressure. Although the mechanism is poorly understood, there is much theoretical support, including negative balance in collagen turnover and decreasing edema. Theoretically, the pressure garment should be applied for 18–24 h each day for a minimum 4 months for up to 24 months. However the compliance with long-term therapy is poor owing to the discomfort caused by the pressure device. Adjusting and relaxing the garment can result in the maximum benefit from therapy and reduce the discomfort. Pressure-gradient garments are designed to exert a pressure of 25–40 mmHg on the underlying tissue. However, many authors claim that pressures less than 25 mmHg can be effective in scar treatment and pressures over 40 mmHg can be harmful and cause complications. The compliance with pressure therapy decreases over time, especially for a long-term treatment protocol.

36.3.4 Silicone

Silicone has become one of the first lines of therapy and the gold standard for hypertrophic scar treatment and prevention [17–19]. It is manufactured in many forms and combined with other dressing media or devices. Silicone is an entirely cross-linked polymer of dimethylsiloxane. Different levels of polymer cross-linking determine the physical and chemical properties of the silicone. In general, as the degree of cross-linking increases, the silicone becomes more durable, but less adherent. Most research has been performed on the therapeutic efficacy of silicone gel sheeting. There are more than 70 silicone products available on the market, and the commonest form is silicone gel sheet. It is a soft, semiocclusive sheet made from medical grade silicone and reinforced with a silicone membrane backing. Some manufactures use other technologies to make the silicone sheet more durable and flexible and to increase breathability. The silicone sheet can be self-adhesive or fixed with adhesive tape or wrap with a bandage. It should only be used on intact skin and should be applied at least 12 h daily for up to 3–6 months. The adverse effects are minor, such as pruritus, maceration, skin irritation, and breakdown. Many clinical trials were conducted to assess the benefit of silicone sheet, but there were some limitations owing to the subjective scar measurement methods. The combination of silicone and pressure therapy is used. The commonest combination is applying silicone gel sheet with a classic pressure garment. There are several manufacturers and designs; however, skin hygiene should be monitored and followed with extra care.

The mechanism of action of silicone remains unclear. Histological analysis revealed no evidence of silicone leakage into the epidermis and no direct activity of silicone on fibroblast function or survival. The characteristic of fluid impermeability and temperature increase might be important. Also, development of a static electric field may be involved in scar involution. The slight increase in temperature caused by silicone gel sheeting can increase collagenase activity, leading to collagen breakdown. Additionally, there is a silicone elastomer sheet that has high oxygen permeability, allowing adequate oxygen tension in the stratum corneum layer. The question remains whether this is of any physiological importance.

36.3.5 Injectable Substances

36.3.5.1 Intralesional Corticosteroids

This method is a long-term standard and the most commonly used therapeutic modality for hypertrophic and keloid scars [20–23]. It has been shown to inhibit α_2-macroglobulin, resulting in collagen degradation, reduction of collagen synthesis, synthesis of glycoaminoglycans, and expression of inflammatory mediators. It can also prohibit proliferative scars by inhibiting cell proliferation and transforming growth factor (TGF) β_1 expression and inducing apoptosis. Triamcinolone acetonide (10–40 mg/ml) is the commonest corticosteroid used for scar treatment. The recommended dosage for monotherapy is 40 mg/ml every 2–4 weeks until the scar is flat. It should be injected in the papillary dermis, where collagenase is produced. Subcutaneous injection must be avoided because it may cause atrophy of underlying fat. The main disadvantage is the pain during injection. Tropical analgesia or intralesional administration of lidocaine or short general anesthesia can be performed if required. The side effects are subcutaneous atrophy, hypopigmentation, and telangiectasias but systemic reactions are uncommon. A large controlled study is still needed to determine the definitive protocol for intralesional corticosteroid injection (Figs. 36.1, 36.2, 36.3, 36.4).

36.3.5.2 Bleomycin

This can cause necrosis of keratinocytes with a mixed inflammatory infiltrate in skin of healthy subjects. In keloid and hypertrophic scars, the effect of bleomycin may be due to a reduction of collagenase synthesis and/or increased destruction owing to inhibition of lysyl oxidase or TGF-β_1. Despite the mechanism being unclear and lack of evidence, a few clinical trials showed a high regression rate, minimum complications, and recurrence in scar treatment with the multipuncture method. Bleomycin is often combined with triamcinolone for intralesional injection.

36.3.5.3 5-Fluorouracil

The effects on scar are due to inhibition of fibroblast proliferation. Combined injection with triamcinolone acetonide

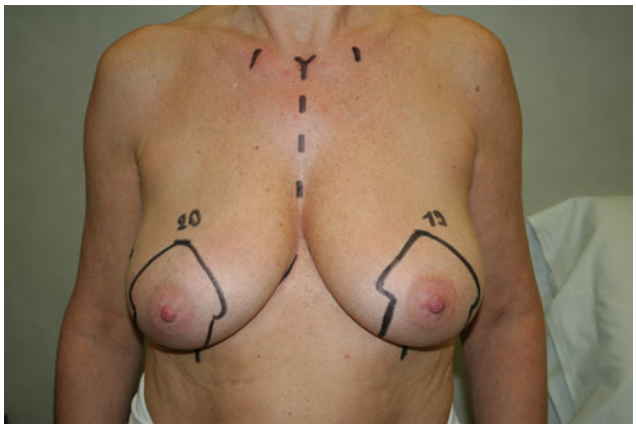

Fig. 36.1 Preoperative view of the patient before inferior right breast quadrantectomy, intraoperative radiotherapy, and bilateral reshaping

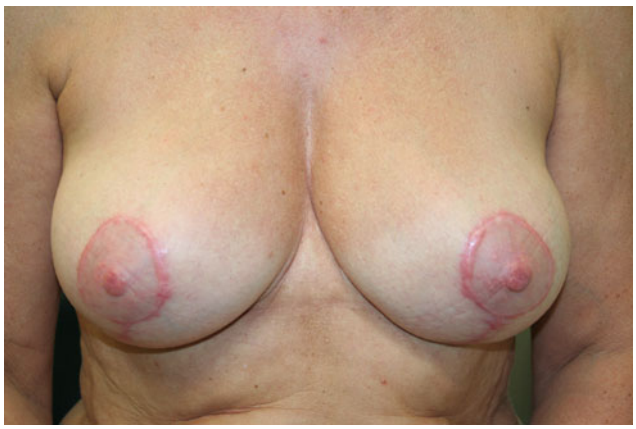

Fig. 36.2 Result at 7 months after the surgery with bilateral hypertrophic scars

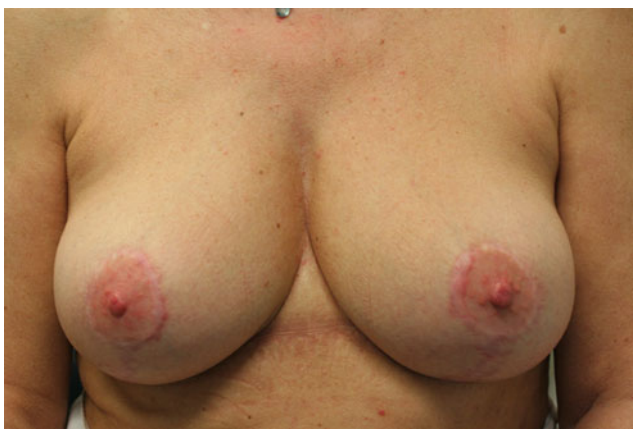

Fig. 36.3 Result at 2 years after three sessions of intralesional corticosteroid injections

is often performed to reduce the dose of 5-fluorouracil. Injection of 5-fluorouracil is also combined with surgical excision. However, it is contraindicated in young women with the possibility of pregnancy and age under 18 years.

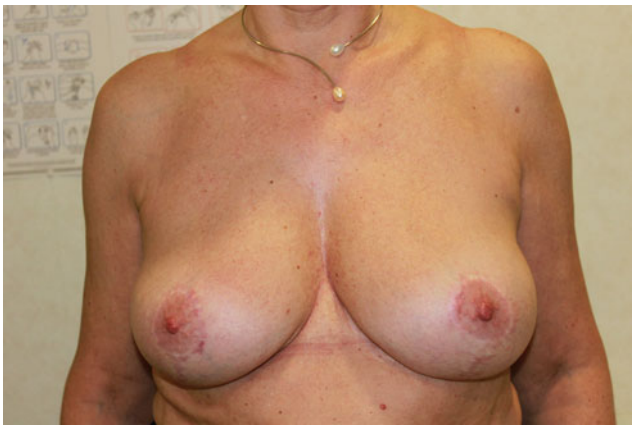

Fig. 36.4 Final result at 4 years

Subcutaneous injection should be avoided. The side effects include a burning sensation and purpura formation.

36.3.5.4 Verapamil

This is a calcium channel antagonist, which can decrease collagen synthesis in extracellular matrix. It stimulates synthesis of the collagen-degradation enzyme procollagenase and increases TGF-β activity. It can be used as a monotherapy or combined with surgery or pressure therapy for keloid treatment. The data on the concentration and complications are limited and should be verified.

36.3.6 Laser

There are several laser applications for scar treatments, as a monotherapy or in combination with other modalities [24–26]. The effects of the laser on scar are mainly limited to the depth and the superficial layer action. Many types of laser used, including ablative lasers, dermal remodeling nonablative lasers, vascular lasers, ultraviolet-B lasers, and intense pulsed light lasers. In general, the selection of laser therapy depends essentially on the patient and the characteristics of the scars. The skin photo type is very important because melanin has a wide absorption spectrum and can be targeted by visible, ultraviolet and infrared light. Isotretinoin affects collagen metabolism and wound repair and its use must be avoided for the 6 months prior to an ablative laser procedure. Anticoagulant and antiplatelet therapies should be discontinued to prevent postlaser purpura. Fractional nonablative laser therapy has been reported with significant improvement in clinical and histopathological appearance [27] in a broad range of posttraumatic scars and surgical scars.

36.3.7 Surgery

A surgeon can improve the scar in both form and more importantly function. Wound management should be

considered as a systematic role from preoperative planning, the intraoperative procedure, and immediate postoperative care until late follow-up [28, 29].

In scar contracture, the principal role of the surgeon is to restore the functions of the patient. Scar contracture release should be performed together with an intense rehabilitation program and if possible other scar therapeutic modalities to prevent contracture recurrence. Surgical management of scar release includes scar revisions, split-thickness skin grafts, full-thickness skin grafts, local flaps, pedicle flaps, and distant microsurgical flaps. The selection of this reconstructive ladder depends on the patient and the scar characteristics. A free flap or perforator flap can give a favorable result in a massive area, deep scarring tissue, and poor surrounding tissue. Dermabrasion, minor scar revision, or simple serial excision with or without tissue expansion can be an effective option in scar management.

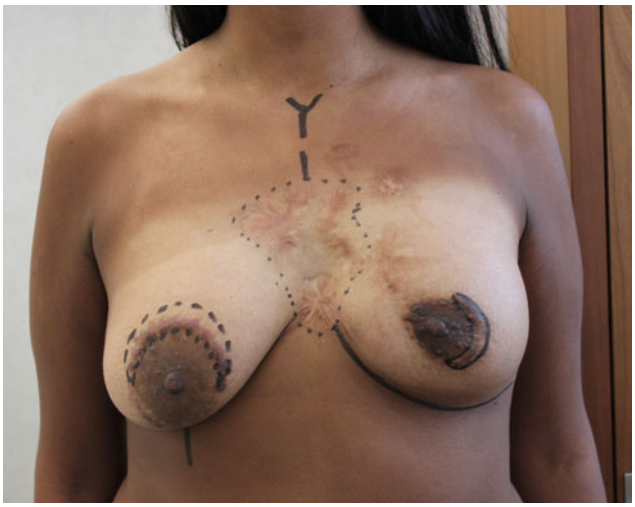

Fig. 36.5 Preoperative result with bilateral keloid scars

36.3.8 Lipofilling

The lipofilling technique has been used for many years and has rapidly become popular especially in aesthetic surgery [30]. In the era of tissue engineering, progenitor and stem cells are being studied and are rapidly gaining interest. The fat is removed by liposuction from the subcutaneous tissue, usually from the abdomen or from the thighs according to the morphology of the patient. The specimen obtained is subjected to soft centrifugation to remove blood cell contaminants and obtain an adipocyte-enriched preparation. Recently, a number of new techniques have been described, mostly based on enzymatic treatments, with the ultimate goal to improve adipocyte purification. After harvesting and processing, the purified fat is injected into the scar area. The lipofilling procedure claims not only to improve the volume deficit but also to improve the color and surface of the scar area.

36.3.9 Radiotherapy

The employment of radiotherapy in the treatment of benign skin disorders, including keloids, is presently allowed only under certain conditions and is subject to compliance with strict protection rules [31, 32]. A series of studies have demonstrated the efficacy and preliminary safety of ionizing radiation beams in their protocols. The combination of surgical and radiotherapeutic treatment causes a synergistic effect relating to scar treatment. Radiotherapy can be delivered at a time when connective tissue is more radiosensitive, by decreasing fibroblast proliferation and causing a rapid mast cell degranulation which reduces histamine levels and is capable of accelerating collagen formation. The total doses of ionizing radiation differ among the different protocols reported in the literature. However, an

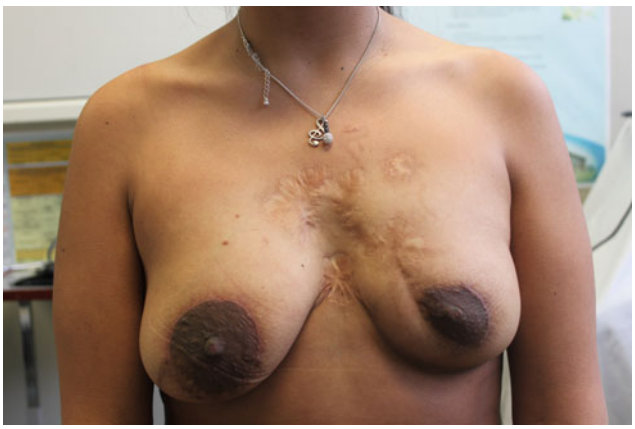

Fig. 36.6 Result after 3 months after scar revision and brachytherapy treatment

increase of the total dose of ionizing radiation administered could theoretically enhance the risk of radiogenic skin cancer for the patients treated. There is a report debating the risk of radiotherapy in the treatment of keloids with regard to the carcinogenicity of radiation. However, no clinical trial has demonstrated this finding in an analytic study despite the potential theoretical risk outlined. Regular X-ray irradiation, electron beam irradiation, and brachytherapy after excision of keloid are performed with favorable outcomes.

36.4 European Institute of Oncology Experience

Hypertrophic scar has been treated surgically followed by brachytherapy according to two different techniques. A total of 51 patients with breast scar are included in the database, and in the first period low-dose radiation (with isolation of the patient) was used in 31 patients, whereas recently a

group of 20 patients were treated with high-dose radiation (without isolation). The recurrence rate was 15.7 % (eight patients), with the global aesthetic result considered as good in 58 % of cases (Figs. 36.5, 36.6).

36.5 Conclusion

In conclusion; several methods, either singly or in combination, can be used for scar treatment and prevention. The position and risk of scar development should be planned before choosing the incision. The biology of cancer and the postoperative adjuvant used in breast cancer treatment must be considered when offering scar management. In the future, genetic therapy and tissue engineering may play roles in primary scar management, treatment, and prevention, which may lead clinicians and patients to achieve maximum satisfaction.

Acknowledgments We thank Middelkoop et al. [33] for providing study contents and references as well as key advices to contribute this chapter.

References

1. Petit JY, Gentilini O, Rotmensz N, Rey P, Rietjens M, Garusi C et al (2008) Oncological results of immediate breast reconstruction: long term follow-up of a large series at a single institution. Breast Cancer Res Treat 112(3):545–549
2. Petit JY, De Lorenzi F, Rietjens M, Intra M, Martella S, Garusi C et al (2007) Technical tricks to improve the cosmetic results of breast-conserving treatment. Breast 16(1):13–16
3. Petit JY, Rietjens M, Contesso G, Bertin F, Gilles R (1997) Contralateral mastoplasty for breast reconstruction: a good opportunity for glandular exploration and occult carcinomas diagnosis. Ann Surg Oncol 4(6):511–515
4. Pulzl P, Schoeller T, Wechselberger G (2006) Respecting the aesthetic unit in autologous breast reconstruction improves the outcome. Plast Reconstr Surg 117(6):1685–1691; discussion 92–93
5. Olascoaga A, Vilar-Compte D, Poitevin-Chacon A, Contreras-Ruiz J (2008) Wound healing in radiated skin: pathophysiology and treatment options. Int Wound J 5(2):246–257
6. Petit JY, Veronesi U, Lohsiriwat V, Rey P, Curigliano G, Martella S et al (2011) Nipple-sparing mastectomy—is it worth the risk? Nat Rev Clin Oncol 8(12):742–747
7. Goutos I, Dziewulski P, Richardson PM (2009) Pruritus in burns: review article. J Burn Care Res 30(2):221–228
8. Cohen IK, Diegelmann RF (1977) The biology of keloid and hypertrophic scar and the influence of corticosteroids. Clin Plast Surg 4(2):297–299
9. Shin TM, Bordeaux JS (2011) The role of massage in scar management: a literature review. Dermatol Surg 38(3):414–423
10. Hallam MJ, Shirley R, Dheansa B, Coker O (2009) Scar massage therapy: a new technique. J Wound Care 18(6):258
11. Richard R, Schall S, Staley M, Miller S (1994) Hand burn splint fabrication: correction for bandage thickness. J Burn Care Rehabil 15(4):369–371
12. Wang CJ, Huang HY, Pai CH (2002) Shock wave-enhanced neovascularization at the tendon-bone junction: an experiment in dogs. J Foot Ankle Surg 41(1):16–22
13. Hess CL, Howard MA, Attinger CE (2003) A review of mechanical adjuncts in wound healing: hydrotherapy, ultrasound, negative pressure therapy, hyperbaric oxygen, and electrostimulation. Ann Plast Surg 51(2):210–218
14. Steinstraesser L, Flak E, Witte B, Ring A, Tilkorn D, Hauser J et al (2011) Pressure garment therapy alone and in combination with silicone for the prevention of hypertrophic scarring: randomized controlled trial with intraindividual comparison. Plast Reconstr Surg 128(4):306e–313e
15. Anzarut A, Olson J, Singh P, Rowe BH, Tredget EE (2009) The effectiveness of pressure garment therapy for the prevention of abnormal scarring after burn injury: a meta-analysis. J Plast Reconstr Aesthet Surg 62(1):77–84
16. Van den Kerckhove E, Stappaerts K, Fieuws S, Laperre J, Massage P, Flour M et al (2005) The assessment of erythema and thickness on burn related scars during pressure garment therapy as a preventive measure for hypertrophic scarring. Burns 31(6):696–702
17. van der Wal MB, van Zuijlen PP, van de Ven P, Middelkoop E (2010) Topical silicone gel versus placebo in promoting the maturation of burn scars: a randomized controlled trial. Plast Reconstr Surg 126(2):524–531
18. Mustoe TA, Cooter RD, Gold MH, Hobbs FD, Ramelet AA, Shakespeare PG et al (2002) International clinical recommendations on scar management. Plast Reconstr Surg 110(2):560–571
19. Schmidt A, Gassmueller J, Hughes-Formella B, Bielfeldt S (2001) Treating hypertrophic scars for 12 or 24 hours with a self-adhesive hydroactive polyurethane dressing. J Wound Care 10(5):149–153
20. Naeini FF, Najafian J, Ahmadpour K (2006) Bleomycin tattooing as a promising therapeutic modality in large keloids and hypertrophic scars. Dermatol Surg 32(8):1023–1029; discussion 9–30
21. Davison SP, Dayan JH, Clemens MW, Sonni S, Wang A, Crane A (2009) Efficacy of intralesional 5-fluorouracil and triamcinolone in the treatment of keloids. Aesthet Surg J 29(1):40–46
22. Giugliano G, Pasquali D, Notaro A, Brongo S, Nicoletti G, D'Andrea F et al (2003) Verapamil inhibits interleukin-6 and vascular endothelial growth factor production in primary cultures of keloid fibroblasts. Br J Plast Surg 56(8):804–809
23. Jung JY, Roh MR, Kwon YS, Chung KY (2009) Surgery and perioperative intralesional corticosteroid injection for treating earlobe keloids: a Korean experience. Ann Dermatol 21(3): 221–225
24. Jared Christophel J, Elm C, Endrizzi BT, Hilger PA, Zelickson B (2012) A randomized controlled trial of fractional laser therapy and dermabrasion for scar resurfacing. Dermatol Surg. doi: http://10.1111/j.1524-4725.2011.02283.x [Epub ahead of print]
25. Lee SJ, Kim JH, Lee SE, Chung WS, Oh SH, Cho SB (2011) Hypertrophic scarring after burn scar treatment with a 10,600-nm carbon dioxide fractional laser. Dermatol Surg 37(8):1168–1172
26. Cho SB, Lee SJ, Chung WS, Kang JM, Kim YK (2010) Treatment of burn scar using a carbon dioxide fractional laser. J Drugs Dermatol 9(2):173–175
27. Vasily DB, Cerino ME, Ziselman EM, Zeina ST (2009) Non-ablative fractional resurfacing of surgical and post-traumatic scars. J Drugs Dermatol 8(11):998–1005
28. Holevich Y, Matev I (1962) Surgical treatment of scar contractures of the hand and fingers following burns. Acta Chir Plast 4:144–155
29. Hazrati E (1959) Break-down of old scar tissue in army recruits and its surgical treatment. Rev Int Serv Sante Armees 32(1):10–13
30. Lohsiriwat V, Curigliano G, Rietjens M, Goldhirsch A, Petit JY (2011) Autologous fat transplantation in patients with breast

cancer: “silencing” or “fueling” cancer recurrence? Breast 20(4):351–357
31. Caccialanza M, Piccinno R, Schiera A (2002) Postoperative radiotherapy of keloids: a twenty-year experience. Eur J Dermatol 12(1):58–62
32. Botwood N, Lewanski C, Lowdell C (1999) The risks of treating keloids with radiotherapy. Br J Radiol 72(864):1222–1224
33. Middelkoop E, Monstrey S, Teot L, Vranckx JJ (ed) (2011) Scar management, practical guide lines, 2011. Maca-Cloetens, Elsene