



Management of Scarring Following Aesthetic Surgery

Alexandra Chambers

Contents

- 45.1 Introduction – 386**
- 45.2 Patient Selection for Cosmetic Surgery – 386**
 - 45.2.1 Evaluating Medical Risks – 386
 - 45.2.2 Assessment of Constitutional and Genetic Risks – 387
 - 45.2.3 Modification of Lifestyle – 388
 - 45.2.4 Psychological Assessment and Expectations Management – 389
- 45.3 Prophylactic Measures in Cosmetic Surgery to Reduce Excessive Scarring – 389**
 - 45.3.1 Choice of Surgical Techniques – 390
 - 45.3.2 Methods to Control Better Healing – 390
- 45.4 Treatment of Scars Following Aesthetic Surgery – 391**
 - 45.4.1 Surgical Treatments – 391
 - 45.4.2 Non-surgical Treatments – 392
 - 45.4.3 Long-Term Management of Patients with Scars After Cosmetic Surgery – 392
- 45.5 Conclusion – 393**
- References – 394**

45.1 Introduction

Aesthetic (Cosmetic) Surgery

Aesthetic surgery's principal purpose is to improve physical appearance and self-esteem.

Demand for cosmetic surgery procedures continues to grow at a rapid pace around the world, with a 9% increase in treatments performed in 2017 compared to the previous year. This translated into 20 million more cosmetic surgery procedures [1]. According to the International Society of Aesthetic Plastic Surgery (ISAPS), the USA, Brazil, Japan, Italy, and Mexico account for 41.4% of the world's cosmetic interventions. Breast augmentation, liposuction, eyelid surgery, rhinoplasty, and abdominoplasty were the most popular treatments.

All surgical procedures have inherent risks, and aesthetic surgery is not an exception. One of the risks is poor scarring, and this can occur from postoperative infection, wound dehiscence, tissue necrosis, or simply from abnormal healing tendencies. Unfavorable scarring is not uncommon following cosmetic surgery; the incidence can vary from 5% after breast augmentation to as high as 8% after abdominoplasty [2, 3]. The impact of excessive scarring can be disturbing to a patient and can incite significant morbidity and psychological distress. The experience can also be disheartening for the surgeon, as the patient will likely blame them for scars. For example, in the UK, approximately a quarter of medical malpractice claims after cosmetic surgery are related to poor scarring and, on average, generate roughly £300,000 in awards [4]. The cost of remedial scar treatment can be quite expensive, taking time and resources of both the patient and the surgeon.

Given the risks of poor scarring, it makes sense for cosmetic surgeons to take as many precautions as possible to avoid inferior outcomes. This chapter explores preventative measures to preclude the occurrence of unacceptable scars, as well as treatment strategies for when they nevertheless develop.

45.2 Patient Selection for Cosmetic Surgery

All cosmetic procedures are elective, and identifying patients at risk for poor scarring is a key starting step. It is important to develop a selective approach in offering aesthetic treatments to reduce unfavorable outcomes and to mitigate potential problems. Patients must be included in the decision-making process, beginning with providing a clear explanation of the risks for their specific case. The surgeon must take the

time to explain and to provide realistic management of patient expectations. Only after clearly describing the risks and answering questions can patients make a valid informed decision.

The scar risk and acceptance matrix (■ Table 45.1) is an example of a simple clinical tool that can be used to quantify the risks of cicatrix formation. This is a communication tool that can help a patient's understanding and, when used in a clinical practice, only requires a few minutes of consultation time. The parameters taken into account for this calculator are the preexisting medical conditions that might affect healing, life style risks, the patient's constitutional tendencies to poor scarring, and the patient's expectations about scar appearance.

Each row of the matrix can contribute an integer value from 1 to 5 according to the descriptions in each column. Adding the results from each row gives a total score, with low values corresponding to low risk. Patients with medium and high risk should be well counseled before their procedure, and the preventative measures (to be described later in this chapter) should be taken before surgery. A very high-risk score might justify declining treatment. The following subsections describe each row of the calculator in more detail.

45.2.1 Evaluating Medical Risks

Reviewing a patient's medical history is key for identifying patients who might be at risk for the types of complications that can lead to poor scarring. The following examples illustrate some of the issues to consider.

- Individuals with cardiovascular disease and hypertension might be at higher risk of bleeding or inadequate tissue perfusion.
- Chronic lung disease and poor peripheral circulation can cause inadequate oxygenation of skin. This in turn could lead to a potential necrosis at the surgical site.
- Autoimmune and connective tissue diseases can give rise to excessive fibrosis and scar thickening. They can also lead to suboptimal collagen deposition, resulting in atrophic or widened scars.
- Immunosuppressed or diabetic patients will have a greater chance of postoperative infection and a problem healing.
- Allergies to certain medications or substances, like latex or adhesive dressings, might compromise an otherwise successful surgery.
- Some medications and supplements can promote postoperative bleeding or predispose to hyperpigmentation.
- Patients, who have previously developed unsightly scars, might be prone to keloid and hypertrophic or atrophic healing.

Table 45.1 Scar risk and acceptance matrix

Score	1	2	3	4	5
Medical risks	None	Hypoxic chronic state CVD Hypertension	Suppressed immunity, including steroid use Diabetes	Autoimmune connective tissue diseases Post-bariatric surgery malabsorption	Peripheral Vascular disease Hyper-viscosity states
Fitzpatrick skin type and constitutional tendencies	Skin 1–3 No history of poor scarring Dry skin with low sebaceous activity	Any skin type Red, pigmented or slightly uneven and lumpy scars BMI > 30	Any skin type Multiple stretch marks, very loose skin Atrophic scars present	Skin 4–5 Previous hypertrophic scar Post-inflammatory hyperpigmentation BMI < 18 Thick skin, higher sebaceous activity	Skin 6 Previous keloid scars
Lifestyle	Healthy life style	Sedentary, hectic lifestyle Binge dieting	No sun protection and overuse of sun beds	Alcohol abuse Recreational drugs use	Smoking (any type) Nicotine replacement
Psychological assessment and patient expectations	Expects scarring Accepts possibility of a poor scarring, including keloid	Expects scarring Hopes for no poor scarring	Expects scarring, which can be easily disguised	Expects scarring but only a minimal	Expects no scar at all

A cumulative score of 5 or below is indicative of low risk for unfavorable scarring and low probability of patient distress with a scar. Scores 6–10 indicate medium risk, scores 11–15 predict high risk, and scores 16–20 very high risk

In summary, a good understanding of the patient's medical history and how this could affect the scar formation process is important for the surgeon's treatment plan, which also helps the patient understand their specific risks. A discussion of these issues is an important part of helping the patient to make an informed decision.

45.2.2 Assessment of Constitutional and Genetic Risks

Being either under- or overweight increases surgical risks, and this also has an effect on postoperative recovery [5]. Patients with one of these characteristics may suffer from nutritional or metabolic abnormalities (or both). Accounting for this before proceeding with a cosmetic surgery is strongly advisable.

Also of note is the specific case for patients who have undergone bariatric surgery to control their weight. These patients often develop a condition of malabsorption and a significant metabolic shift.

For some individuals, there will be inherent familial or racial risks that can contribute to excessive scarring. Although, no specific genetic mechanisms have yet been identified, individuals with the skin type 4–6 on the Fitzpatrick scale are at higher risk for more noticeable

scars [6]. Both the *MYH9* gene (coding for a non-muscle myosin) and apolipoprotein1 (*APOL1*) have been implicated in non-diabetic kidney disease and keloid scarring in people of African descent (see Fig. 45.1). There is a hypothesis that a haplotype *MYH9-APOL1* is likely responsible for keloid formation [7]. Brown et al. [8] found a genetic association between *HLA-DRB1*15* status and the risk of developing keloid scarring in individuals with a pale complexion.

In a practical clinical consultation, the surgeon can simply enquire about ethnicity and make an examination of the patient's skin. Pigmentation tendencies and any previous scars or marks (for example from vaccinations or injections) will help estimate risks. Figure 45.2 illustrates a tendency to form a keloid scar following mesotherapy injections for improving fine décolletage lines.

Note that age plays a role in constitutional scarring tendencies. Older patients with thinner and dryer skin have almost no chance of developing keloid scarring, whereas teenagers with higher sebaceous and cellular activity have a higher chance of developing pronounced scars.

As already stated, poor scarring can negate the benefits of the cosmetic surgery. A careful explanation of the risks is essential before embarking on a procedure.



Fig. 45.1 Unilateral keloid scar formation after gynecomastia and mastopexy surgery in a patient of African origin with skin type 6



Fig. 45.2 Nodular keloid scarring after a needle prickle of pre-sternum skin

The patient needs to be fully informed and should have the time to weigh the risks versus the benefits of a procedure. Procedural planning and early preventative interventions can change the balance toward a more acceptable final outcome.

45.2.3 Modification of Lifestyle

A patient's lifestyle choices can have important effects on their postoperative recovery, including scarring. It is important to assess these types of risks and to advise the patient on the steps to be taken before and after surgery. Furthermore, as some patients may not fully follow proposed lifestyle modifications, it is wise for the surgeon to plan on compliance tests and to enter these into the patient's medical record prior to surgery.

It is well known that smoking tobacco products has a detrimental effect in the perioperative period by expos-

ing tissue to the effects of nicotine, carbon monoxide, hydrogen cyanide, and nitric oxide. These all impair wound healing. There are numerous retrospective and prospective cohort studies of levels 2 and 3 evidence demonstrating the relationship between smoking and delayed postoperative healing.

That said, there are studies with level 1 evidence showing ameliorating effects on surgical outcomes when preoperative smoking is discontinued for 4 weeks or longer prior to surgery [9]. When embarking on a smoking cessation protocol, patient compliance should be checked with a carbon monoxide breath or urinary cotinine test just prior to surgery.

Heavy use of alcohol can cause vasodilatation and increase perioperative bleeding. Patients should be advised to refrain from drinking alcoholic beverages for 2 weeks before and after their surgery. A blood test for gamma-glutamyl transferase (GTT) can establish whether a patient is abstaining and compliant with the recommendation.

A balanced diet and supplements of vitamin D, zinc, and iron have a positive impact on postoperative healing.

Substance abuse can have complex effects that potentially include reducing a patient's compliance to preoperative protocols, and this can also decrease their immunity. These types of issues are serious enough; however, it should be noted that in some regulatory contexts, individuals suffering from addictions might not be considered capable of giving a valid consent to cosmetic surgery.

Physically fit, active, and psychologically stable individuals tolerate surgery better and recover faster [10].

In summary, it is important that the patient be informed that their surgical outcome will depend on lifestyle. This should be particularly emphasized for those who need to make changes prior to surgery.

45.2.4 Psychological Assessment and Expectations Management

Evaluating a patient's psychological state of mind can be challenging for cosmetic surgeons; however, it is an essential component of every presurgical consultation. It is important to evaluate a patient's motivations for surgery for several reasons. First, it can give an indication of whether they will be apt to follow the key pre- and postsurgical advice they have been given to optimize their surgical outcomes. Second, it can help identify those patients who may have unreasonable expectations and give an indication of the likelihood of them becoming combative or litigious (regardless of the outcome). Finally, it is a required step in determining whether a patient suffers from body dysmorphic disorder (BDD), which, depending on the regulatory context, could potentially legally disqualify them from surgery.

Psychological assessment and expectations management is a difficult process, especially since most surgeons are not trained in how to do this. There are some common sense steps that can be used without too much difficulty. The first is to look for indicators of psychological imbalance during the consultation process. For example, note whether the patient is overly concerned with minor cosmetic defects. If this is the case, then even the most nominal scarring will likely be unacceptable to the patient.

Show the patient before- and after-photos for a broad spectrum of surgical outcomes, and ask them for feedback on which ones correspond to their hopes and expectations. If the patient indicates a strong preference for an unrealistic outcome for their body type and age, the surgeon should factor this observation into the score.

The consultation process should be used to determine the history of psychological treatments, as well as the patient's history of past cosmetic procedures. Although a patient may hide their psychological care, a physical examination will turn up scars that may be easily associated with past cosmetic surgeries. This can be used to begin a conversation about the patient's satisfaction with past procedures, and what revisions they have undergone.

Finally, the surgeon should always ask the patient for permission to contact their general practitioner (GP) for a confirmation of their medical history. If the patient refuses, this might be a warning flag, although it may simply be due to negative social perceptions of aesthetic surgery. However, if the patient's medical condition or medical history might possibly contraindicate a surgical procedure, it is essential that the patient obtain a letter from their GP indicating that undergoing surgery would be safe.

Realize that no psychological evaluation will be 100% effective. Some patients with psychological issues such as BDD will have learned how to game doctors with credible answers. Nevertheless, the surgeon must make a good effort at trying to provide the patient with an

honest assessment while also avoiding harming patients who are at risk. There are some practical tools that can be considered for this.

First, consider making a video recording of all consultations with every patient. This will be the primary record of what was discussed, including facts presented about surgical risks, and indications of the patient's expectations.

Make liberal use of before- and after-photos. It can be quite difficult to understand a patient's perspective, and it is equally difficult for a patient to understand the likely outcomes without concrete examples. Particularly important is the patient's appreciation of scarring patterns and their acceptance of their inevitability. The before- and after-photos present an excellent opportunity for gauging the patient's sentiments on scarring.

Asking the patient for permission to contact their GP is an important step of the consultation process. The GP can often provide relevant information about the patient's medical history that is relevant to the safety of a surgical procedure.

Finally, it is worthwhile to be abreast of psychological risk factors for various segments of the population and to fold such statistics into the patient's overall evaluation. For example, some patients might not be open about their true motives for cosmetic interventions, and in some contexts, their aims might be controversial [11]. Recognized factors associated with a poor psychosocial outcome of aesthetic surgery include [12] the following:

- Being of a young age and of male gender
- Having unrealistic expectations of the procedure
- Having had previous unsatisfactory cosmetic treatments
- Exhibiting minimal deformity
- Motivations based on relationship issues
- A history of depression, anxiety, or personality disorder

For cases where the surgeon has a serious doubt about a patient, it makes sense to defer surgery while collecting more data. The surgeon can insist on a letter from the GP stating their opinion that it would be safe for the patient to undergo surgery. In highly borderline cases, it might make sense to ask the patient to undergo a psychological assessment before proceeding with treatment.

45.3 Prophylactic Measures in Cosmetic Surgery to Reduce Excessive Scarring

Scarring is an inevitable result of all surgeries; however, as already discussed, patients will be more critical and less accepting of scars from cosmetic procedures than for those obtained after surgeries for illness or injury. Even after extensive preoperative counseling, patients

typically do not fully appreciate the realities of scarring. This means that cosmetic surgeons should make every effort to minimize scarring by utilizing all available tools and methods to optimize healing. This section reviews a range of current options.

45.3.1 Choice of Surgical Techniques

Careful planning is the best approach to achieving success for any surgery, and this is especially true for elective cosmetic procedures. The following discussion provides a list of points that should be planned for prior to surgery.

Meticulous surgical field preparation and antibacterial prophylaxis are crucial in mitigating risk of infection. Infiltration with local anesthetic and adrenaline, combined with a careful hemostasis, will help reduce bleeding during and after the operation. Both infection and hemorrhage can be detrimental to wound healing and should be avoided at all cost.

The surgeon must take care not to damage vascular dermal plexus when undermining skin and take into account blood supply via a vascular pedicle when lifting flaps and cutting through tissues. Inadvertently damaging local circulatory pathways will lead to skin necrosis and devastating consequences.

Incisions should be made bearing in mind the natural skin tension vectors. Avoiding crossing these will diminish the likelihood of wound dehiscence, scar widening, or hypertrophy. Similarly, avoid areas with tight skin such as the presternal, upper shoulders, and over the extensor surfaces of joints [13].

Try to strategically hide scars by placing incisions as much as possible in the natural creases of the skin or where imperfections can be disguised by clothing.

Finally, a cosmetic surgeon must handle tissues gently, approximate edges of the wound carefully, and make use of fine instruments and suturing materials. While closing tissue incisions, a surgeon should bear in mind how the tensile strength of the wound will evolve during the healing process. The tension strength of the wound, related to cross-linking of collagen, will only be 3% of that of a normal skin after roughly 1 week, 30% after 3 weeks, and 80% after about 12 weeks [14]. This should be reflected in the choice of suturing techniques and materials. Non-absorbable sutures can be removed after 7–10 days, but appropriate additional scar holdup is required during the first 3 months with adhesive tapes, dressings, and garments.

45.3.2 Methods to Control Better Healing

Postsurgical techniques to influence and optimize scar formation are varied. Some methods are well established, while others are still experimental. A brief review of modalities currently in use is summarized here.

- Compression garments to reinforce tensile strength across a wound and to reduce stretching and friction
- Adhesive tapes and plasters
- Topical flavonoids
- Botulinum neurotoxin type A (BoNTA)
- Platelet-rich plasma (PRP)
- Microneedling + topical applications
- Imiquimod
- Bioengineering and recombinant DNA

The first step in postsurgical scar optimization is the use of compression therapy. Although the effects are poorly understood, compression keeps wounds reinforced and prevents both stretching and friction. A wide range of compression and support garments are available. Pressure levels should be sustained at 15–40 mmHg for at least 23 h/day over a period of 6 months. This presents, however, a problem of patient compliance due to restrictiveness of such a regime.

This can be managed with the use of various adhesive tapes and plasters to cover the already closed wounds. These keep the scar undisturbed and protected and can be more comfortably used over a longer period of time. A randomized controlled study of 70 patients using a paper tape on their wounds showed this to be an effective strategy [15].

More specialized dressings and skin substitutes can be utilized to promote epithelization by creating matrix for a cellular migration, providing a protective barrier, and sustaining a moist environment. Silicone gel and sheets have been shown to reduce unfavorable scarring in randomized controlled studies [16, 17], but a meta-analysis of 13 trials involving 559 patients demonstrated only weak evidence that silicone can reduce the incidence of abnormal scarring in high-risk individuals [18]. That said, silicone softens the scar and makes it more comfortable for patients, and because of this, it may be worthwhile. It is recommended to use silicone dressing for at least 12 h a day for 2 months from 2 weeks after the surgery.

Topical flavonoids such as Contractubex (Merz Pharma, Frankfurt, Germany) or Mederma skin care gel (Merz Pharmaceutical, Greensboro, CA, USA) are used to keep scars soft and supple from the second week after surgery for up to 6 months. Their efficacy has been found to be controversial, but the dietary bioflavonoid quercetin can also improve scarring by suppressing fibroblasts proliferation via inhibition of SMAD intercellular transduction protein [19]. This reduces the actions of the transforming growth factor β (TGF- β) and reduces fibroblasts activity.

In clinical practice, cosmetic surgeons can use botulinum neurotoxin type A (BoNTA) immediately after wound closure. Injections of 15U of the preparation have been shown to improve scarring following 6 weeks after a facelift [20].

Platelet-rich plasma (PRP) has gained some popularity for skin anti-aging, chronic wound management, and scar therapy. Treating a wound bed with PRP has shown substantial benefits for better wound healing, an increased survival of fat grafts, and the acceleration of cartilage and bone grafts uptake in a systematic review of 15 randomized controlled trials and 25 case-controlled studies [21]. Platelet-rich fibrin also proved to be useful in aesthetic and reconstructive applications.

Also note that the repeated microneedling at a controlled depth and topical application of retinol and marine collagen reversed both atrophic and hypertrophic scars to a more even appearance after a year of treatment [22].

Attempts have been made to use Imiquimod 5% cream to prevent keloid recurrence after surgical excision. This topical immune-response modulator stimulates a proinflammatory cytokine interferon, which increases collagen breakdown. Imiquimod also alters the effects of apoptosis-associated genes. The preparation was used daily for a fortnight after a surgery. Later it was applied three times a week under a dressing for 1 month. The efficacy for this prophylaxis is still questionable, as the result of this double-blinded, placebo-controlled pilot study showed no significant difference in keloid deposition rates in the two groups [23].

Interesting research in tissue bioengineering is attempting to bring new methods to improved wound healing, with an objective of even achieving scarless regeneration. Promising results have been obtained using therapies based on TGF- β . A preparation of a recombinant version of this cytokine marketed as Juvista by Renovo Laboratory (Manchester, UK) has shown a 70% improvement in wound healing and scar appearance in a phase 2 trial. Other therapies developed by the same company include formulations of mannose-6-phosphate (M6P; marketed as Juvindex) and another preparation based on estradiol (marketed as Zesteem) [24].

In another study, a preparation of recombinant human TGF- β 3, called avotermin, was injected before the skin was cut and again 24 h after wounding in healthy participants. A dose of 50 ng/100 μ l of the drug per linear centimeter achieved 10% scar improvement in three double-blinded, placebo-controlled studies. However, the investigators had commercial interests in TGF- β 3, which may weaken their claim. Nevertheless, they demonstrated a strict adherence to established protocols and research standards and conducted a rigorous statistical analysis [25].

Whatever methods be used to prevent unfavorable scarring, they must be initiated early enough to influence the processes of tissue healing. Failure to do so might lead to florid scarring that might subsequently be more difficult to treat.

45.4 Treatment of Scars Following Aesthetic Surgery

Pronounced scarring following surgery is common. Up to 40% might display hypertrophic scar features, and 6–16% of these will evolve into a keloid scar (especially for patients of African descent). Scar atrophy can result from wound infection and inflammation, but it is less common.

If, after all other precautions, a scar begins to display features of pathological healing, or is simply too noticeable, treatment plans are still available and can do much to remediate the situation. Management of scars after aesthetic surgery does not differ from any other scar treatment. The therapeutic approach can be divided into surgical and non-surgical methods.

45.4.1 Surgical Treatments

Traditionally, keloid and hypertrophic scars are excised, and tissue is manipulated to allow for more favorable healing afterward. Excision with a linear, tension-free closure should be used. If the defect is a large one, or the wound is in a high skin-tension area, a split- or full-thickness skin grafting with Z-plasty or W-plasty skin closure flaps is recommended (■ Fig. 45.3). That said, hypertrophic scars tend to spontaneously regress for up to 12 months. This suggests that surgical revisions should probably not be made until after a 1-year time window.



■ Fig. 45.3 Skin flap closure with W-plasty following a forehead lift with hair line advancement surgery

Hypertrophic scars rarely recur after excision, and as such, they require no adjuvant treatments following the removal. Keloid scars on the other hand can redevelop after excision. This will occur in more than half of all cases, and so will likely require additional therapeutic interventions. This should be undertaken immediately after their excision.

The most commonly used methods for controlling keloid scar recurrence include corticosteroid injections or radiotherapy. In recent years, a mixture of 5 fluorouracil (5FU) with triamcinolone has become popular. The cocktail is made of 3 ml of 5FU 50 mg/ml and 1 ml of the steroid containing 40 mg/ml triamcinolone. An amount of 1–2 ml of this mixture is used for postoperative tissue infiltration at the level of excision plane and below it. The treatment can be repeated after full epithelialization of the wound. Postoperative pressure should be applied for 6 months afterward, and silicone gel should be used for 2 months.

45.4.2 Non-surgical Treatments

A broad range of treatments with no cutting of scars is available for cosmetic surgeons. Therapeutic choices vary from injectable preparations to interventions based on a variety of technologies. Whatever method is being employed, it should be done in a timely fashion with stepwise escalation to the next option if the current one is ineffective.

The first choice of non-surgical treatment for early keloid formation scars is intra-lesional corticosteroid injections. In most cases, steroid injections act as a second-line modality for hypertrophic scars if less-invasive options, such as silicone dressings and support tapes, fail.

Corticosteroids suppress inflammation in the wound; they reduce collagen and glycosaminoglycans synthesis, while increasing collagen degradation. Glucocorticoids inhibit fibroblasts proliferation and enhance their degradation. The most commonly used preparation is triamcinolone 40 mg/ml. A dose of 10 mg or 40 mg is injected into a scar, every 1–2 months. Usually two to three sessions are all that is required. Scars become flatter and softer with alleviation of symptoms, but a recurrence rate is common and can be as high as 50%. Side effects of corticosteroid injections are telangiectasia and dermal atrophy. Topical corticosteroid preparations in the form of creams can be massaged into post-blepharoplasty scars. Corticosteroid tapes are sometimes applied after aesthetic surgery for breast reduction. However, efficacy of topical corticosteroids for scar reduction has never been proven.

Laser treatment modality is next in line after corticosteroids. Pulsed-dye laser (PDL) with a wavelength of 585 nm is most commonly used for treating scars as a stand-alone

intervention or in addition to other treatments. Pulse-shots at a fluency of 3.5–5.5 J/cm² are fired to cover the entire scar, making sure the shots do not overlap. Treatments are repeated four to six times every 3 weeks. Hyper- and hypopigmentation, blistering, and small bruises are possible after the treatment but tend to be transient.

It is sometimes possible to destroy scar tissue by subjecting it to subzero temperatures. For example, cryotherapy with liquid nitrogen is an option. Rarely used to improve scars caused by cosmetic surgery, it can be nevertheless be useful for pretreatment before repeating injections of corticosteroids in smaller scars. This is especially the case if laser is unavailable or has proven to be ineffective.

Recalcitrant scars can be subjected to radiotherapy. This method is mostly combined with the surgical excisions but is rarely used in aesthetic practice. The methods of radiotherapy choice include superficial X-rays, electron beam therapy, and low or high-dose-rate brachytherapy. They all can be utilized, but not for breast or tummy tuck scars due to their potential for carcinogenic side effects.

Atrophic tissue healing is another type of pathological scarring, leading to a volume loss and an indented surface formation. The treatment objective is to restore the tissue deficit and to reinforce thinning and hollowing of the scar surface. For the former, corrections are made with fillers and fat grafts. The latter can be achieved with stimulating therapies such as microneedling, Sculptra injections, free-floating PDO, or gold threads. An example study using a controlled depth microneedling approach proved to be effective for both atrophic and hypertrophic scars [22]. Early keloid scars can also respond to this type of intervention (■ Fig. 45.4). This suggests that all pathological scars may have similar pathways for regression.

Another promising modality for treatment of scarring is botulinum neurotoxin type A (BoNTA). Keloid can be treated successfully with diluted BoNTA and the technique for that is described in ► Chap. 8.

45.4.3 Long-Term Management of Patients with Scars After Cosmetic Surgery

Even with a conscientious effort made by both the patient and the surgeon to control and optimize scarring, some patients will find it difficult to accept their outcomes. These patients may be especially psychologically vulnerable if their scars are located in areas easily seen. Examples include the eyelids after a blepharoplasty or in front of the ears after pretragal incision used during rhytidectomies.

The surgeon has some responsibility to help these types of patients come to terms with their scars. The



■ Fig. 45.4 Keloid scar following rhytidectomy was improved by using microneedling and topical retinol

process will likely involve a combination of approaches, including counseling, cognitive behavioral therapy, camouflage makeup, and medical tattooing. A multidisciplinary approach to the psychological rehabilitation of the patient will likely be needed to succeed. The surgeon should be empathetic to the patient's perspective and be prepared to help with what can often be a lengthy and arduous process.

45.5 Conclusion

Scarring after cosmetic surgery is the same as that from accidents, disease, or other types of surgical procedures. The context, however, is completely different. Patients

primarily choose aesthetic surgery for non-essential health reasons. Because of this, when poor scarring occurs, cosmetic surgeons are at much higher risk for patient dissatisfaction and potential legal action.

A wide variety of therapeutic and prophylactic methods are available for the management of posttraumatic and postsurgical cicatrix. Thus, the main point of this chapter is that surgeons should put into place pre-, intra-, and postsurgical processes to mitigate scarring risks.

Finally, regardless of the objective severity of cosmetic surgical scars, this is an important component of a patient's perception of the success of the procedure. Surgeons should take an active role in providing patients with information and compassionate support.

Take-Home Messages

- Always bear in mind that a scar following aesthetic surgery impacts a patient far more than its objective evaluation and it negatively contributes to the overall perception of otherwise successful treatment.
- Carefully evaluate the potential risk of scarring and take appropriate measures to reduce it prior to surgery.
- Manage patient expectations by providing sufficient explanation of the range of potential outcomes.
- Avoid offering elective cosmetic surgery to people at high risk of very poor scarring or to those with highly unreasonable expectations.
- Plan and execute an appropriate surgical technique.
- Employ prophylactic measures and treatments in a timely fashion.
- Take active measures to minimize the formation of keloid and hypertrophic or atrophic scarring should they occur.
- Keep careful records (written and video) of the consultation process, surgical techniques, and postsurgical treatments, making specific mention of the management of scarring.
- Provide emotional and medical support to a patient, who is troubled by a scar after her or his aesthetic surgery.

References

1. International Society of Aesthetic Plastic Surgery (ISAPS) Statistics 27 June 2017, Hanover, Germany. <https://www.isaps.org/wpcontent/uploads/2017/10/GlobalStatistics.PressRelease>.
2. Stewart KJ, Stewart DA, Coghlan B, Harrison DH, Jones BM, Waterhouse N. Complications of 278 consecutive abdominoplasties. *J Plast Reconstr Aesthet Surg*. 2006;59(11):1152–5.
3. Nava MB, Rancati A, Angrigiani C, Catanuto G, Rocco N. How to prevent complications in breast augmentation. *Gland Surg*. 2017;6(2):210.
4. Stone C. Scar revision costs, Unsightly Claims. *Personal Inj Law J*. 2011;15–9. <https://www.medicalandlegal.co.uk/wp-content/uploads/2012/05/Scar-Revision-cost-in-Personal-Injury-Law-Journal.pdf>.
5. Saldanha O, Salles A, Llaverias F, Saldanha C. Predictive factors for complications in plastic surgery procedures-suggested safety scores. *Rev Bras Cir Plást*. 2001;29(1):105–13.
6. Bayat A, Bock O, Mrowietz U, Ollier WE, Ferguson MW. Genetic susceptibility to keloid disease and hypertrophic scarring: transforming growth factor beta1 common polymorphisms and plasma levels. *Plast Reconstr Surg*. 2003;111(2):535–43.
7. Keeling BH, Taylor BR. Keloids and non-diabetic kidney disease: similarities and the APOL1–MYH9 haplotype as a possible genetic link. *Med Hypotheses*. 2013;81(5):908–10.
8. Brown JJ, Ollier WE, Thomson W, Bayat A. Positive association of HLA-DRB1*15 with keloid disease in Caucasians. *Int J Immunogenet*. 2008;35(4–5):303–7.
9. Rinker B. The evils of nicotine: an evidence-based guide to smoking and plastic surgery. *Ann Plast Surg*. 2013;70(5):599–605.
10. Levett DZ, Edwards M, Grocott M, Mythen M. Preparing the patient for surgery to improve outcomes. *Best Pract Res Clin Anaesthesiol*. 2016;30(2):145–57.
11. Macgregor FC. Selection of cosmetic surgery patients: social and psychological considerations. *Surg Clin N Am*. 1971;51(2):289–98.
12. Honigman RJ, Phillips KA, Castle DJ. A review of psychosocial outcomes for patients seeking cosmetic surgery. *Plast Reconstr Surg*. 2004;113(4):1229.
13. Son D, Harijan A. Overview of surgical scar prevention and management. *J Korean Med Sci*. 2014;29(6):751–7.
14. Buchanan PJ, Kung TA, Cederna PS. Evidence-based medicine: wound closure. *Plast Reconstr Surg*. 2016;138(3S):257S–70S.
15. Atkinson JA, McKenna KT, Barnett AG, McGrath DJ, Rudd M. A randomized, controlled trial to determine the efficacy of paper tape in preventing hypertrophic scar formation in surgical incisions that traverse Langer's skin tension lines. *Plast Reconstr Surg*. 2005;116(6):1648–56.
16. Gold MH, Foster TD, Adair MA, Burlison K, Lewis T. Prevention of hypertrophic scars and keloids by the prophylactic use of topical silicone gel sheets following a surgical procedure in an office setting. *Dermatol Surg*. 2001;27(7):641–4.
17. Chan KY, Lau CL, Adeeb SM, Somasundaram S, Nasir-Zahari M. A randomized, placebo-controlled, double-blind, prospective clinical trial of silicone gel in prevention of hypertrophic scar development in median sternotomy wound. *Plast Reconstr Surg*. 2005;116(4):1013–20.
18. O'Brien L, Pandit A. Silicon gel sheeting for preventing and treating hypertrophic and keloid scars. *Cochrane Database Syst Rev*. 2006;(1):CD003826.
19. Phan TT, Lim JJ, Sun L, Chan SY, Bay BH, Tan EK, Lee ST. Quercetin inhibits fibronectin production by keloid-derived fibroblasts. Implication for the treatment of excessive scars. *J Dermatol Sci*. 2003;33(3):192–4.
20. Chambers A. Effects of botulinum toxin a observed during early scar formation following rhytidectomy: controlled, double-blinded pilot study. *Am J Cosmet Surg*. 2018;36(2):78–84.
21. Sommeling CE, Heyneman A, Hoeksema H, Verbelen J, Stillaert FB, Monstrey S. The use of platelet-rich plasma in plastic surgery: a systematic review. *J Plast Reconstr Aesthet Surg*. 2013;66(3):301–11.
22. Chambers A. Unified approach to the treatment of hypertrophic and atrophic scars: a pilot study. *Am J Cosmet Surg*. 2016;33(4):176–83.
23. Berman B, Harrison-Balestra C, Perez OA, Viera M, Villa A, Zell D, Ramirez C. Treatment of keloid scars post-shave excision with imiquimod 5% cream: a prospective, double-blind, placebo-controlled pilot study. *J Drugs Dermatol*. 2009;8(5):455–8.
24. Rhett JM, Ghatnekar GS, Palatinus JA, O'Quinn M, Yost MJ, Gourdie RG. Novel therapies for scar reduction and regenerative healing of skin wounds. *Trends Biotechnol*. 2008;26(4):173–80.
25. Bush J, So K, Mason T, Ocleston NL, O'Kane S, Ferguson MW. Therapies with emerging evidence of efficacy: avotermin for the improvement of scarring. *Dermatol Res Pract*. 2010;2010:690613.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

