The Management of Post-acne Scarring

a report by
Greg J Goodman, MD, FACD

Chief of Surgery, Skin and Cancer Foundation of Victoria and Monash University Department of Community Medicine

Greg J Goodman, MD, is Chief of Surgery at the Skin and Cancer Foundation of Victoria and is a senior lecturer in the department of Community Medicine at Monash University. He has been a dermatologist for over 20 years and is a recognized expert in the field of dermatology and skin care with special interests in the areas of skin cancer, lasers, cosmetic dermatology and the treatment of acne and acne scarring. He is a preceptor for the American Society of Dermatologic Surgery (ASDS). Dr Goodman is on a number of international editorial boards and advisory committees has published numerous peer-reviewed journal articles, chapters in text books and continues his research in many facets of dermatology. He has been a guest speaker for many specialists' colleges in fields as diverse as ophthalmology, otolaryngology, and plastic surgery. He has been a keynote speaker at many international conferences including those held in New Zealand, US, Japan, and Italy. He is currently co convening the 5th World Congress of the International Academy of Cosmetic Dermatology. He has always had a keen interest in skin care and skin therapeutics having written on nail cosmesis, the role of moisturisers, skin care and acne and acne scarring therapies. Dr Goodman graduated with an MD from Monash University 1978 and becoming a fellow of the Australasian College of Dermatology in 1984. He completed a micrographic skin cancer fellowship in 1993 and a graduate diploma in Clinical Epidemiology in 2003.

Abstract

Background

Therapeutic intervention for post-acne scarring has historically been limited by the considerable morbidity of most treatments for only marginal disease improvement. Within the last decade, however, a greater understanding of the pathogenesis of acne scarring has led to the development of techniques that offer more favorable risk-benefit profiles.

Objective

The aims of this article are to highlight a number of newer techniques and to assign their appropriateness to particular grades of acne scarring.

Methods and Materials

Current modalities are discussed as they relate to disease process and specific acne scar types. Techniques are presented in order of most effectual therapeutic interventions for defined grades of acne scarring. Acne scarring grades have been described in terms of disease load, severity, and lesion morphologies.

Results

A comprehensive discussion of updated therapeutic techniques and their biologic rationales in the treatment of acne scarring is presented. These include targeted interventions of inflammatory and post-inflammatory processes, angiogenesis, immunologic processes, dermal and subcutaneous fibrosis, hypertrophy, and keloid scarring.

Discussion

A requirement for developing successful treatments for post-acne scarring is a greater understanding of its pathogenesis, variability amongst afflicted individuals, and the inflammatory mediators and immunology of the scarring process. Many innovative techniques have been introduced in the past decade attempting to counteract these pathologic processes while keeping the procedural and post-operative risks to a minimum.

Introduction

Post-acne scarring can be a physically disabling and psychologically devastating disease. Unfortunately, it is not particularly well treated. The more morbid resurfacing procedures are becoming less popular and are being challenged by new and innovative procedures that require less recuperation. Older techniques have been modified in attempts to improve risk–benefit profiles.

Various attempts have been made to describe post-acne scars morphologically: by identifying the scar type, then suggesting therapy appropriate for that type.[1–3] A qualitative grading system (see *Table 1*) will be used as a template for describing some of these new techniques[4]—one that attempts to classify patients according to the severity of their scarring and thus their burden of disease.

Macular Acne Scarring and Marking (Grade I Acne Scarring)

Scarring is visible irrespective of distance and represents not a problem of contour like other scar grades, but of color. The color may be red, white or various shades of brown to black. Erythematous, hyperpigmented and hypopigmented macules each arise in different scenarios and require specific treatments.

Mild Atrophy or Hypertrophy (Grade II Acne Scarring)

These are superficial atrophic-type scars, or rolling scars. They may not be obvious at social distances of 50cm or greater and may be covered adequately by make up, the normal shadow of shaved beard hair in males, or by normal body hair if extrafacial. This is the group probably most at risk from the practitioner who suffers from the adage, "If the only tool you have is a hammer, you tend to see every problem as a nail".[5] In other words, this group is in danger of both exaggerating their problem and of being over-treated

by physicians with traditional resurfacing procedures, especially if the treating physician is not skilled with a wide armamentarium of procedures.

Moderate Atrophy or Hypertrophy (Grade III Acne Scarring)

This level of scarring is obvious at social distances of 50cm or greater and is not covered easily by make up or the normal shadow of shaved beard hair in males, or by body hair if extrafacial. However, it is still able to be flattened by manual stretching of the skin. It equates to the rolling and shallow box car atrophic-type scars and the moderate hypertrophic and keloidal scars.

Severe Atrophy or Hypertrophy (Grade IV Acne Scarring)

This type of scarring is obvious at social distances of 50cm or greater. It is not covered easily by make up or the normal shadow of shaved beard hair in males, or by body hair if extrafacial, and is not able to be flattened by manual stretching of the skin. This group comprises punched out atrophic (deep 'box car'), 'ice pick' scars, bridges and tunnels, marked atrophy, dystrophic scars and significant hypertrophy or keloid.

The treatments hereof have arguably advanced faster than those for the less severe end of the spectrum of disease. There have been reports of success in treating this type of scarring with resurfacing techniques only,[6,7] but generally, the mainstays of treatment for punched out scars have been punch techniques, with or without resurfacing.

Therapy of scars

Macular Acne Scarring and Marking

Red erythematous macular changes are quite well targeted by vascular lasers and light sources.[8] For hyperpigmented macules, reparative treatment may not always be required. If treatment is sought, medical therapy may suffice with topical reparative creams and/or light skin peels. Hypopigmented macules have traditionally been quite refractory to treatment. There have, however, been scattered reports of re-pigmentation following manual dermabrasion[9] and needle dermabrasion[10] (utilising a tattoo gun without pigment) and autologous cell transfer.

Mild Atrophy or Hypertrophy (Grade II Acne Scarring)

Those in this group may have only few scars and benefit from fairly simple treatments, or they may have many scars and need more substantial treatment.

Table I: Grades of Post-acne Scarring

Grade	Level of disease	Likely treatment options	Characteristics
1	*Macular disease*	*Time, optimized home skin care, light strength peels, microdermabrasion, vascular or pigmented lasers or intense pulsed light (IPL).*	*Erythematous, hyper- or hypopigmented flat marks visible to patient/ observer at any distance.*
2	*Mild disease*	*Non-ablative lasers, blood transfer, skin needling or rolling, microderm abrasion, dermal fillers.*	*Mild atrophy or hypertrophy that may not be obvious at social distances of 50cm or greater and may be covered adequately by make up or the normal shadow of shaved beard hair in males or normal body hair if extrafacial.*
3	*Moderate disease*	*Ablative lasers, dermabrasion, medical skin rolling, dermal fillers if focal, subcision and blood transfer. Intra-lesional corticosteroids steroids or fluorouracil and/or vascular laser if hypertrophic.*	*Moderate atrophic or hypertrophic scarring that is obvious at social distances of 50cm or greater and is not covered easily by make up or the normal shadow of shaved beard hair in males or body hair if extrafacial, but is still able to be flattened by manual stretching of the skin.*
4	*Severe disease*	*Punch techniques (float, excision grafting), focal trichloroacetic acid (CROSS technique) with or without resurfacing techniques. Fat transfer, occasionally rhytidectomy if grossly atrophic. Intralesional corticosteroids, steroids, or fluorouracil and/or vascular laser if hypertrophic.*	*Severe atrophic or hypertrophic scarring that is obvious at social distances of 50cm or greater and is not covered easily by make up or the normal shadow of shaved beard hair in males or body hair if extrafacial, and is not able to be flattened by manual stretching of the skin.*

For patients with few scars, the last decade has seen the advent of a bewildering array of injectable fillers for both short- and long-term tissue augmentation. In treating those with many scars, microdermabrasion utilising Aluminium Oxide crystals has become a very popular technique and has been suggested to be useful in the treatment of facial scarring.[11]

Skin rolling, also termed collagen induction therapy, connotes the repeated needling of the skin with small needles. It is the author's practice to always supplement

Figure 1: Laser Resurfacing

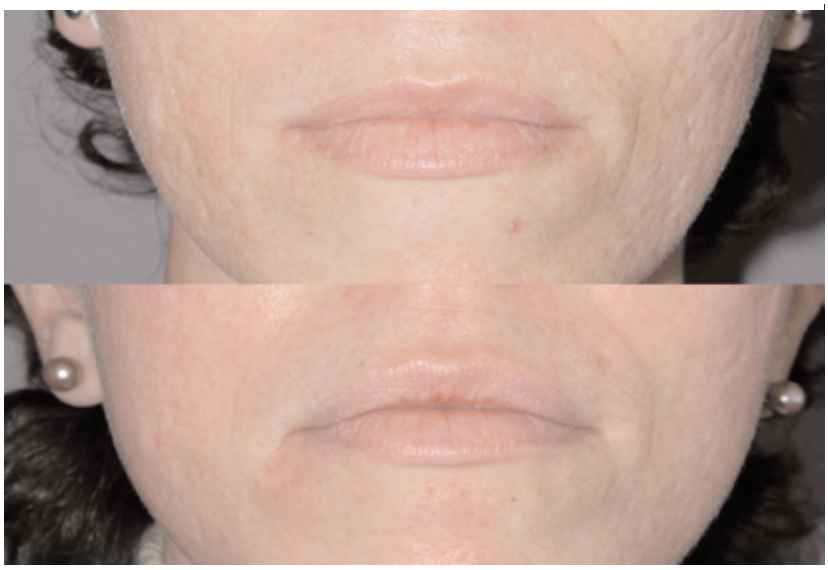
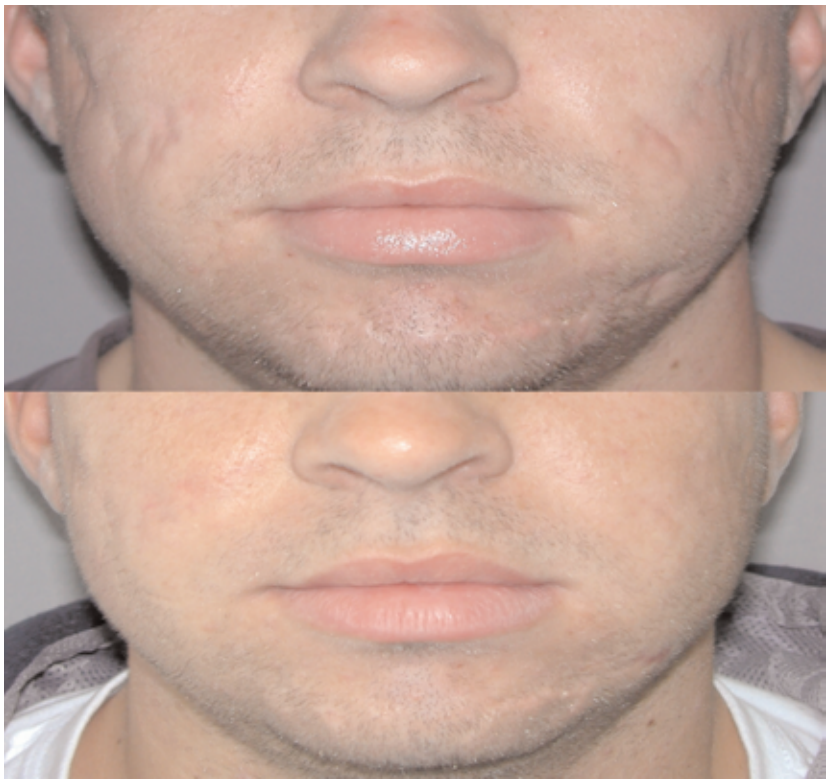


Figure 2: Laser Resurfacing Subcision and Fat Transfer



the procedure of skin rolling or needling with other procedures, both simultaneously (blood transfer, vascular laser and subcision for bigger scars) and sequentially, starting one month after the procedure and continuing monthly for three treatments (non-ablative 1,450nm diode laser).

Non-ablative lasers appear to have a role in this type of scarring. Repeated treatments are required and longevity of result is still largely unknown. It has long been found that the more significant the dermal insult, the more eventual collagen deposition and improvement one seems to note.[12] However, this has up to now come with the issue of increasing morbidity and risk. With the advent of non-ablative resurfacing and fractionated photothermolysis, maybe this nexus of significant results and significant risk can be broken.

Moderate Atrophy or Hypertrophy (Grade III Disease)

If there are few scars, then their augmentation by temporary or longer-term autologous or external agents may be appropriate. Combinations of techniques, such as subcision, blood transfer, non-ablative, or vascular laser and skin needling, may be useful for more significant scarring. As a simple technique that appears to produce long-term correction of contour defects, subcision deserves to be a first-line treatment for many isolated moderate atrophic scars. More recently fractionated resurfacing is becoming the new gold standard for this type and severity of acne scarring. Similar in concept to needling it also has the advantage of truly resurfacing the epidermis and deeper tissues rather than just injuring the dermis. This may be used for few or widespread scars.

For those with many scars, technique sensitive resurfacing (ablative lasers, radiofrequency, medium strength peels, plasma, and abrasion) may be recommended (see *Figure 1*). Plasma skin resurfacing seems another useful addition to this disease type and severity.

Moderate Hypertrophic Disease

Where moderate hypertrophic disease is evident, the treatments that have been described over the last decade have included vascular laser and fluorouracil (and other cytotoxics such as tattoo type application of bleomycin) injections. More recently, intralesional verapamil or topical imiquimod[13] have been suggested as post-operative adjunctive treatments to surgical excision of keloidal scars.

Severe Atrophy or Hypertrophy (Grade IV Acne Scarring)

For punched out atrophic scars, punch techniques such as punch excision,[14] grafting[15] and elevation or float techniques[16] have been useful and probably remain the gold standard for larger punched out scars (deep 'box car' and larger 'ice pick' scars). More recently focal trichloroacetic acid,[17] termed the CROSS technique, has excited interest for the treatment of smaller 'ice pick' and poral type scars, which have always been difficult.

Where widespread grossly atrophic disease has destroyed deeper tissue, fat remains the optimal

replacement agent. Fat is an excellent deeper augmentation material. Fat transfer can assist both cosmetically—by reproducing the youthful appearance of a fuller face in acne scarred patients—and reconstructively, by providing a deep foundation for deep acne scarring (see *Figure 2*).

The Future of Acne Scarring Therapy

The question of why one patient is able to heal without scarring whilst another with apparently similar severity goes on to scar has always been vexing. Recently, one study examined this by comparing these patient-types. They found that there were noticeable differences in their inflammatory profile whilst healing.[18] In particular, they found that there was a healthy, early, relatively non-specific and robust inflammatory infiltrate typical of a type IV hypersensitivity response with significant early angiogenesis in patients not prone to scarring, all in keeping with effective and rapid clearing of the offending antigen. In contrast, patients prone to scarring tended to show a relatively more specific, but ineffectual, early inflammatory response.

Angiogenesis remained high in resolving lesions with a further stage of inflammation comprising macrophages and skin-honing memory cells. The study's practitioners suggest that based on the poorly resolving inflammation, scarring would be a more likely outcome and therefore they suggest a role for anti-inflammatory medications.

It may follow that if we are to intervene with physical therapies, it may seem reasonable to target either the poorly resolved inflammatory response or the equally poorly resolving angiogenesis. Vascular lasers and light sources could be looked at with this in mind. Many common agents have both anti-inflammatory and anti-angiogenesis characteristics and may deserve investigation to help avert early acne scarring. It is also possible that research activities surrounding new anti-angiogenesis agents as anti-cancer treatments may yield further useful agents for this approach.[19]

Summary

Correcting post-acne scarring remains a very difficult task. Great strides may be made in this condition only with a greater understanding of its pathogenesis, the reasons why certain people scar and others don't, the inflammatory mediators, and the immunology of the scarring process. The variety of scars mirroring the variety of acne lesions means that no simple, single process is likely to provide an answer to all acne scars. There have been some imaginative additions to treatment of both hypertrophic and atrophic disease but we still seem to be far away from successful resolution for this distressing disease. ■

References

1. *Orentreich D, Orentreich N, "Acne scar revision update",* Dermatol Clin *(1987);5: pp. 359–368.*
2. *Kadunc BV, Trindade de Almeida AR, "Surgical treatment of facial acne scars based on morphologic classification: a Brazilian experience",* Dermatol Surg *(2003);29: pp. 1200–1209.*
3. *Goodman G, "Post-acne scarring: a review",* J Cosmet Laser Ther *(2003);5: pp. 77–95.*
4. *Goodman GJ, "Post-acne scarring—a qualitative global scarring grading system. (Accepted into Derm Surg 2006).*
5. *Abraham Maslow quotes (American philosopher and psychologist, 1908-1970). http://en.thinkexist.com/quotation/if_the_only_tool_you_have_is_a_hammer-you_tend_to/221060.html*
6. *Jeong JT, Kye YC, "Resurfacing of pitted facial acne scars with a long-pulsed Er:YAG laser",* Dermatol Surg *(2001);27: pp. 107–110.*
7. *Woo SH, Park JH, Kye YC, "Resurfacing of different types of facial acne scar with short-pulsed, variable-pulsed, and dual-mode Er:YAG laser",* Dermatol Surg *(2004);30: pp. 488–493.*
8. *Alster TS, McMeekin TO, "Improvement of facial acne scars by the 585 nm flashlamp-pumped pulsed dye laser",* J Am Acad Dermatol *(1996);35: pp. 79–81.*
9. *Roxo RF, Sarmento DF, Kawalek AZ, Spencer JM, "Successful treatment of a hypochromic scar with manual dermabrasion: case report",* Dermatol Surg *(2003);29: pp. 189–191.*
10. *Camirand A, Doucet J, "Needle dermabrasion",* Aesthetic Plast Surg *(1997);21: pp. 48–51.*
11. *Tsai RY, Wang CN, Chan HL, "Aluminum oxide crystal microdermabrasion. A new technique for treating facial scarring",* Dermatol Surg *(1995);21: pp. 539–542.*
12. *Stegman SJ, Tromovitch TA,* Cosmetic dermatologic surgery, *Chicago, Year Book Medical Publishers (1984): pp. 47–76.*
13. *Berman B, Villa A, "Imiquimod 5% cream for keloid management",* Dermatol Surg *(2003);29: pp. 1050–1051.*
14. *Gravelink JM, White VR, "Concurrent use of laser skin resurfacing and punch excision in the treatment of facial acne scarring",* Dermatol Surg *(1998):24; pp. 527–530.*
15. *Johnson W, "Treatment of pitted scars. Punch transplant technique",* J Dermatol Surg Oncol *(1986);12: p. 260.*

16. *Orentreich N, Durr NP, "Rehabilitation of acne scarring",* Dermatol Clinics *(1983);1: pp. 405–413.*
17. *Lee JB, Chung WG, Kwahck H, Lee KH, "Focal treatment of acne scars with trichloroacetic acid: chemical reconstruction of skin scars method",* Dermatol Surg *(2002);28: pp. 1017–1021.*
18. *Holland DB, Jeremy AH, Roberts SG, et al., "Inflammation in acne scarring: a comparison of the responses in lesions from patients prone and not prone to scar",* Br J Dermatol *(2004);150: pp. 72–81.*
19. *Tortora G, Melisi D, Ciardiello F, "Angiogenesis: a target for cancer therapy",* Curr Pharm Des *(2004);10: pp. 11–26.*