Single session customised multimodal acne scar rehabilitation: An overview and guide to treatment planning

Nina Wines[1], Jill Waibel[2,3,4], Rebecca Quiñonez[2], Shreya Andric[1], Elizabeth Dawes-Higgs[1], Andrea Tomizawa[1,5], Ishana Dixit[1]

1. Northern Sydney Dermatology and Laser, Northbridge, Sydney
2. Miami Dermatology and Laser Institute, Miami, FL, USA
3. University of Miami, Miami, FL, USA
4. Wright State University, Dayton, OH, USA
5. The Skin Hospital, Darlinghurst, Sydney, NSW, Australia

Correspondence: Nina Wines info@drninawines.com

CLICK IMAGE TO LINK TO VIDEO DURATION_01:24

OUTLINE: Acne scars remain one of the most detrimental and long-term sequelae of patients dealing with acne vulgaris. A variety of approaches are currently utilised in acne scar management including prevention, surgical correction, laser therapy, and energy-based devices. The heterogenous nature of acne scars, such as size, colour, depth, and severity, makes them a stubborn but responsive condition that requires multiple treatment modalities. Treatment burden due to perceived lack of efficacy is considerable, and costly, and the need to achieve quality results more rapidly in fewer treatment sessions is important. Combination therapies have proven to be more effective than monotherapies, and with the proper knowledge and expertise, can work safely and synergistically to expedite results. There is no current gold standard or guide for a customised single session multimodal treatment plan of acne scars; therefore, the authors present an algorithm for patient assessment and treatment planning for the management of acne scars.

Objective measurements to assess the success of a single session multimodal treatment can pose a challenge. The wide variety of scars along with their severity, and the infinite number of modalities, patient factors and treatments available make it all the more challenging. The use of a universal global grading, planning and treatment documentation system for single session multimodal treatments may assist in improving the opportunity in the future to help categorise patients by severity of scarring and number of modalities per session.

Herein, the authors discuss cases of patients with acne scars where improvement was noted by using multiple procedures in the same treatment sessions.

KEYWORDS: acne scars, scar, multimodal, treatment planning, subcision

Wines N, Waibel J, Quiñonez R, Andric S, Dawes-Higgs E, Tomizawa A, Dixit I. Single session customised multimodal acne scar rehabilitation: An overview and guide to treatment planning. Opin Prog Cosmet Dermatol 2022;2(3):53-64.

Introduction

In today's world, time is a commodity for both patients and providers. Maximising treatment efficacy by combining procedures in one session is important, especially for those affected by acne scars. Treatment for acne and acne scars can take a prolonged period to show results, thus can place financial implications on patients.[1] Furthermore, acne scars can negatively influence self-esteem and self-confidence leading to a perceived decrease in employability, reduced emotional well-being, and socialisation.[2,3] From the authors' clinical experience, a perceived prolongation of achieving the desired results, coupled with downtime, multiple office visits to the dermatologists, and costs of treatment, all negatively influence patients to defer treatment altogether.[1] There is a need for dermatologists to treat acne scars in a more effective and time efficient manner.

The advent of technology and availability of topical and oral treatment options has expanded the armamentarium of clinicians to manage acne scarring. Studies have shown that combination therapies

are more effective than monotherapies and can be performed safely and synergistically when performed by a highly trained specialist.[4]

Herein, the authors discuss cases of patient with acne scars where improvement was noted by using multiple procedures in the same treatment sessions.

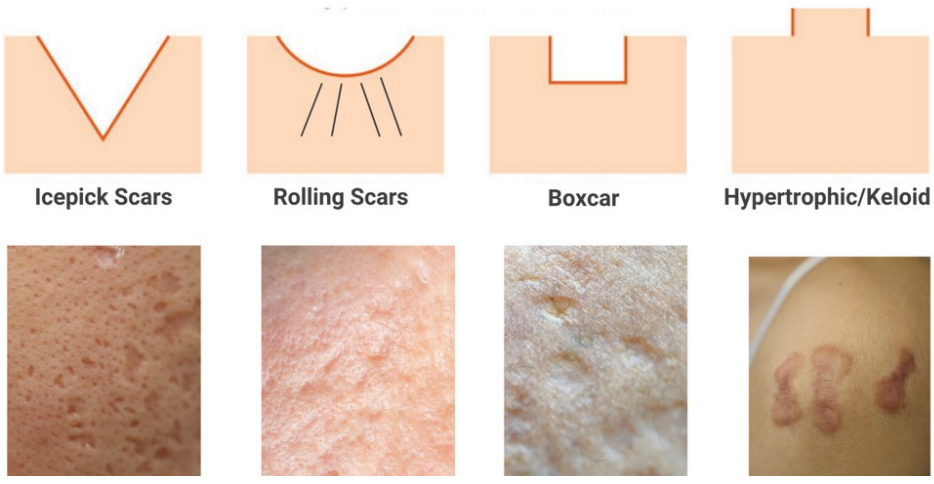
Acne scar pathogenesis

Acne scarring begins with the evolution of a non-inflamed comedone into an inflammatory lesion that ruptures through the weakened infra-infundibular section of the follicle leading to a perifollicular abscess. Outcome depends on the extent and depth of inflammation. If inflammation is severe enough it may extend directly into the subcutis.[5] Although the pathogenesis of acne scarring is still not fully understood, several hypotheses have been proposed. Acne scarring results from abnormal wound healing responses in cutaneous inflammation.[6] Wound healing is broadly divided into three stages: inflammation, granulation tissue formation, and matrix remodelling.[7] In patients with acne scars, the initial inflammation of the wound healing process is found to be slower, stronger, and longer in duration.[8] Indeed, severity of acne scars is highly correlated with the initial acne grade.[9] During the second stage of tissue repair, granulation tissue is formed, and new collagen is produced by fibroblasts approximately 3 to 5 days after the wound is created.[10] Abnormal collagen production and degradation has been found to influence the various types of acne scars. The third stage of wound healing is characterised by the formation of a lytic cascade for matrix remodelling, including extracellular matrix metalloproteinases (MMPs) and tissue inhibitors of MMP that are produced by fibroblasts and keratinocytes. Acne scars have been shown to result from an imbalance in the ratio of these MMPs to tissue inhibitors of MMPs.[11] Recent studies have also confirmed a higher expression of interleukin (IL)-1 beta expression in acne vulgaris, and acne scar lesions compared to normal skin. This expression correlated to the clinical severity of acne and the degree of pathological inflammation. IL-1 beta hence could play an important role in subsequent acne scarring.[12]

The outcome of acne inflammation is an atrophic, hyperplastic or keloid response. Many acne scars result from a net degradation of collagen, resulting in atrophic scars in 80-90% of cases.[6] Types of atrophic acne scarring include ice pick, boxcar, and rolling scars (Figure 1). When the imbalance of MMPs and tissue inhibitors of MMPs results in a diminished deposition of collagen factors, atrophic scars result. Given inflammation is induced below the epidermis in the infra-infundibular region of the pilosebaceous unit, subsequent scarring often involves deeper structures. As the scar contracts, it draws in the surface layer leading to atrophy or indentation. The location, depth and extent of inflammation will determine the amount, type, and depth of scarring.[5]

Less commonly, an exuberant healing response leads to a net proliferation of collagen, resulting in the development of a hypertrophic scar, more common in the jaw, chest, and shoulders. Furthermore, some patients may be more prone to hypertrophic (and keloid) acne scars, and these lesions have been shown to demonstrate a lack of collagenase activity.[13] Superficial wounds rarely produce a hypertrophic or keloid diathesis. Keloids seem to be due to poorly resolved reticular dermal inflammation. When inflammation is confined to one or a few follicular structures a more focal type of scarring may ensue. Lost elastin from inflammation does not return and is replaced by denser collagen.[14]

Figure 1. *Visual representation of acne scar types*



Multiple forms of acne scars may occur in the same patient and can be influenced by other factors such as genetics, hormone dysfunction, and wound healing. Furthermore, external variables such as scratching, picking, and extracting lesions may also influence the type of scarring that occurs.

Scar morphology

Acne scars present with a heterogeneous range of texture, colour, contour, depth, size, and severity. For these reasons, combination therapy and combining energy-based technologies with procedural modalities such as subcision, soft tissue fillers, trichloroacetic acid (TCA) chemical reconstruction of skin scars (CROSS) and punch excision in a single session provides patients with superior and faster outcomes.[4] Table 1 lists and describes the different types of acne scars.

Prior to managing acne scarring physicians require a full understanding of the array of procedural options that are available for acne scar rehabilitation. Within this edition we have provided an overview of various modalities to act as a guide.

The practitioner plans and designs treatment in accordance with the scar and patient factors and then oversees the treatment process over a period which varies depending on scar severity and complexity. Treatment engineering and design is adapted as the practitioner accounts for patient factors and results along the patient journey. The clinician must understand their patient's needs, emotions, budget, own limitations, and experience as well as availability and access to equipment. It is essential to remove bias to your own equipment and what it can achieve and refer to other clinics with better facilities if necessary.

Table 1. *Overview of acne scar morphology according to their size, shape, and depth*[5]

Type of scar	Size	Shape	Depth	Proportion
Atrophic				
Ice pick	<2 mm	V-shaped taper as it extends to dermis. Opening may be smaller than the infundibulum[13,14]	Deep vertical penetration into dermis to subcutaneous plane	60%
Boxcar	1.5-4 mm	Round to oval, sharply formed vertical edge. Opening of the infundibulum has the same width	Can be shallow (0.1-0.5 mm) or deep (>0.5-4 mm)	20%
Rolling	4-5 mm	Wide, shallow, sloped	Tethering of the dermis to the subcutaneous tissue	10-15%
Hypertrophic	Variable	Papule/nodule	Variable, 2-10 mm	10-20%
Keloid	Variable	Extending beyond lesion margins	Can be extensive, >10 mm	

Single session multimodality acne scar rehabilitation – A practical guide to treatment planning

The concept of single session multimodal combination treatment was discussed by Taylor et al.[15] Combinations of energy-based technologies with TCA CROSS, subcision, soft tissue filler, microneedling and/or punch excision in one session expedites results compared to solo treatments and are increasingly being performed (Table 2). The authors have found that having this established method has enabled efficient preparation for treatments and has ensured the booking of patients appropriately. Planning ahead of time assures clinicians have ample time to follow-up with patients and enhance the outcome and overall experience for patients. The number of total sessions is determined at every follow-up visit, however, having a clear expectation should be set in the initial consult.

Case studies

Patient communication is paramount to successful management and planning of acne scar treatment. The authors present four cases to emphasise the impact of patients' expectations, financial implications, and timeframes for treatment on planning. Other factors that impact design include scar type, severity, skin type and the presence or absence of active inflammatory acne.

Table 2. *List of studies using combination treatments leading to more effective results than single treatments alone*

fCO2 combination	fCO2 + IPL is effective in Chinese patients: 4-6 sessions[16]
	fCO2 + PRP intradermal injections[17]
	fCO2 + allogenic stem cells[18]
	fCO2 + RF intensifies thermal effect and provides better results in less time with fewer treatment sessions[19-20]
	Spot fCO2 plus global non-ablative fractional laser[21]
Microneedling combination	Microneedling + PRP or glycolic peels improvement in acne scarring increased to 62%[22]
	Microneedling + PMMA[23]
Subcision	Subcision prior to fCO2 yields better results[24]
	Microneedling RF combined with prior subcision leads to better results than microneedling RF alone[25]
	Microneedling followed by PMMA in 14 patients lead to 96% improvement[26]
	Microneedling + fillers + 1320 Nd:YAG combination led to superior results[27,28]
	Microneedling + 20% TCA peel + fractional ablative erbium under tumescent anaesthetic[15]
	Microneedling + Cross-Linked HA or PLLA threads[29]
	Microneedling + Endolift (200 nm fibres)[30]
	Microneedling + PRP[31]
Chemicals	Acids + fractional radiofrequency[32]

fCO2, fractional CO2; HA, hyaluronic acid; IPL, intense pulsed light; Nd:YAG, neodymium yttrium aluminium garnet; PLLA, poly-L-lactic acid; PMMA, polymethylmethacrylate; PRP, platelet-rich plasma; RF, radiofrequency; TCA, trichloroacetic acid

Case 1.

Patient factors	Skin and scar factors	Treatment plan/execution
Caucasian 60 yo Busy executive Limited time Wanted results quickly Cost not a concern No previous treatment	FST II Subcutaneous atrophic scarring Atrophic dermal scarring Boxcars and ice pick scars	**One session: Layered HA filler** **Step 1:** Deep subcutaneous injection first with cannula Slow bolus injection of high cross-linked HA 20 mg/mL (2 mL) **Step 2:** Superficial subcision with blunt cannula technique followed by HA 17.5 mg/mL subdermally (2 mL) **Step 3:** Superficial droplet injection HA to rolling superficial scars **Step 4:** TCA 70% brush technique to ice pick scars **Reviewed** 3 months later for second session with longer-acting filler. No treatment required as results sustained. **Maintenance** Review annually and gradually switch to a longer-acting filler.

a. before
b. after

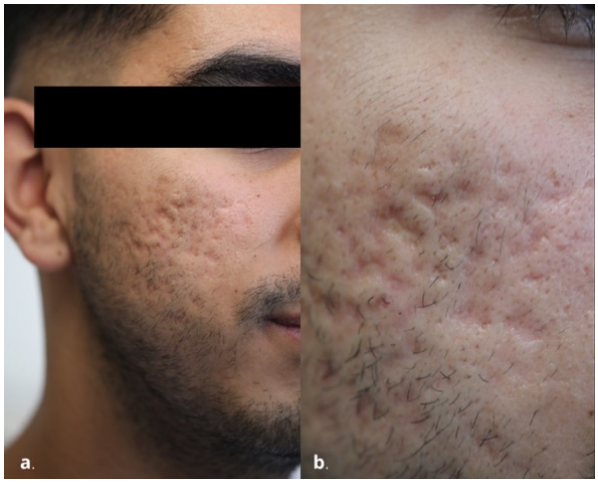
Case 2.

Patient factors	Skin and scar factors	Treatment plan/execution
Asian 26 yo Health care worker Limited time Wanted minimal downtime and gradual results over a 2-year period Finances a concern No previous treatments	FST III Ice pick and box scarring largely Lesions close together	**Three sessions** **Session 1: Introductory test patch** Designed to ease the patient into treatment to demonstrate result and downtime of various techniques. A small number of punch elevations, punch excision performed and trial of TCA 50% and 70% brush performed. **Session 2: 4 weeks later** Patient indicated she liked the results of TCA 70% and preferred punch elevation to punch excision. However, on close inspection the rim of punch elevation could be seen. Whilst this could be resurfaced, she elected not to have this done due to potential downtime. She progressed to a session of TCA 70% alone followed by post treatment HQ (Tri-Luma®) starting day 7 post treatment. RF also performed on the same day. **Session 3: 6 weeks later** 30% improved. Repeat of the above. Patient very pleased with results. Due to her personal time constraints and desire for minimal downtime and slow results, 3 further sessions planned over the 12-month interval. Hoping to progress her to fractionated resurfacing for blending. **Maintenance** Once a satisfactory end point is achieved annual review to monitor progress.

a. Visia Standardised before photo
b. Macro view
c. Session 1 – introductory test patch

Case 3.

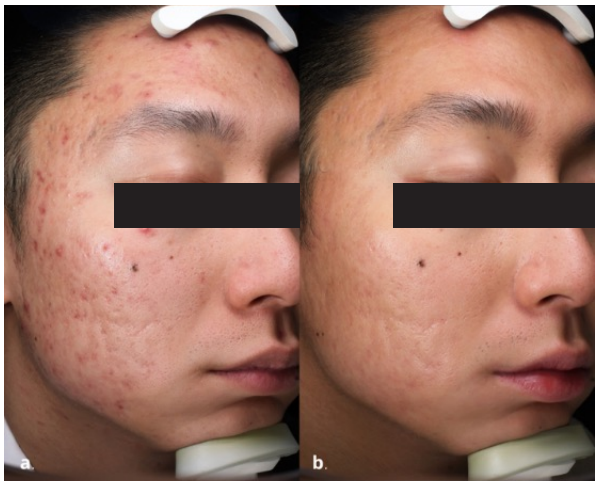
Patient factors	Skin and scar factors	Treatment plan/execution
Indian descent 36 yo Recent immigrant to Australia Works in hospitality Commute to medical office a concern, time off work and financial implications a concern Profound effects on self esteem	FST IV Atrophic, boxcar, rolling, linear, and some with combined morphology	**Two sessions** **Session 1** Goal to achieve as much impact in one session as possible. Was able to source a compassionate supply of filler. **Step 1:** Subcision – relatively aggressive, followed by layered HA filler of different cross linking followed by superficial droplet filler **Step 2:** Surgical excision larger scars > 3.5 mm. Punch excision some 2-3 mm ice pick and boxcars **Step 3:** TCA CROSS using brush technique **Step 4:** fCO2 (low density high fluence) and RF **Step 5:** Post treatment HQ after suture removal Follow-up with emailed photography monthly. **Session 2: 3 months later** **Step 1:** Repeat subcision and layered HA filler followed by droplet filler **Step 2:** Combination RF and fCO2 **Step 3:** Post treatment HQ (Tri-Luma®) **Maintenance** Single annual treatment planned thereafter.



a. Visia Standardised before photo
b. Macro view

Case 4.

Patient factors	Skin and scar factors	Treatment plan/execution
Asian 26 yo University student, just graduating and taking on a major first job Expects results in 3 months, prior to starting job No downtime available once new career starts	FST III Atrophic and ice pick scars Moderate inflammatory acne	Discussed with patient realistic expectations given time frame and active acne lesions. Pre-treatment with oral isotretinoin 20 mg for 8 weeks prior to commencing treatment. Patient to remain on isotretinoin throughout the course of acne scarring treatment. **Session 1: 8 weeks after low dose isotretinoin** **Step 1:** Subcision followed by layered HA filler (20 mg/mL and 17.5 mg/mL – one mL of each due to financial factors) **Step 2:** RF to reduce downtime in combination with light low-density CO2 given intercurrent isotretinoin, downtime available and risk of PIH **Session 2: 3 months later due to work commitments** Same as above **Plan for further sessions** – time frame uncertain due to intensity of his new job and commitments. Aiming for 2 further 6 monthly sessions until has reached satisfied endpoint. **Maintenance** Annual review to determine if top up treatments required.



a. Visia Standardised before photo
b. After isotretinoin for 8 weeks

CROSS, chemical removal of scar tissue; fCO2, fractional CO2; HA, hyaluronic acid; HQ, hydroquinone; PIH, post-inflammatory hyperpigmentation; RF, radiofrequency; TCA, trichloroacetic acid

Designing the single session multimodal treatment plan

Accurately assessing a patient's skin type and type of acne scar is an important component for determining a treatment plan. In the authors' collective experience, patients appreciate a clinician who empathises with the impact acne scarring has made on their social and professional life. Clinicians should remain empathetic and understanding, while also establishing reasonable expectations of treatment outcomes.

Step 1. Classify and grade acne severity

The most adopted system is the Qualitative Scarring Grading System first described by Goodman and Baron in 2006.[33] This is a simple index of severity that can be compared over time between clinicians and treatment sessions. Acne scars are subdivided into grades 1-4 based on scar severity. The system further categorises the scar according to its distribution with focal involvement of a single cosmetic unit as "A" and two or three areas of distinct disease involvement as "B" (Table 3). Grading enables a quantitative overall impression of the individual's acne scarring severity.

When it comes to treatment planning physicians need to be cognisant of the topographical variation in surface contour of scarring within each individual. Scar type varies from location to location on the face. Atrophy topography can also vary from superficial, to subdermal to subcutaneous within the same patient. Technique and modality vary depending on the scar type and atrophic scar depth. By way of example, subcision with or without a less cross-linked hyaluronic acid filler may be performed for superficial subdermal atrophic scars and then a higher cross-linked hyaluronic acid filler may be employed for the deeper subcutaneous scarring. Other modalities will be required depending on scar type within that patient. For example, TCA CROSS with brush may be used for ice pick scars and intralesional corticosteroids employed for hypertrophic scars. The physician may also need punch devices should surgical procedures be performed for the individual.

Within this edition Goodman discusses the classification and management of less severe surface predominant acne scarring versus severe atrophic acne scarring.

Step 2: Assess skin type

Skin type influences choice of treatment. Darker skin types can be managed with most modalities, and when necessary, precautions are taken. An array of cosmeceutical agents may be used for preprocedural and post-procedural management. One study reports that starting patients on hydroquinone once daily for 6 weeks prior to treatment can decrease the potential for post-inflammatory hyperpigmentation (PIH).[34] Lowering the densities, fluence and number of passes when using energy devices and avoiding aggressive techniques enables effective management. Longer pulse durations, epidermal cooling and spacing treatments further apart are also helpful. A short course of topical corticosteroids post treatment may also be helpful. Discussion about proper photoprotection cannot be underestimated and patients should be counselled appropriately.

Step 3: Surface colour – red, brown, or white

Examine the skin for underlying skin dyschromia or other conditions, such as rosacea. Determine if there is any post-inflammatory erythema, post-inflammatory hyperpigmentation or hypopigmentation that the patient wishes to address. Within this edition, Goodman discusses options for the management of surface colour in patients with less severe surface predominant acne scarring.

In addition to options mentioned by Goodman it is worthy to note the beneficial effect of topical pharmaceuticals for post-acne scar hyperpigmentation. Retinoids used in combination with hydroquinone and corticosteroids are effective, but can cause irritation.[35] Hydroquinone is used in combination with retinoids and corticosteroids. Risk of irritation, steroid-induced atrophy and ochronosis can occur;[35] the authors' preferred agent is Tri-Luma® (fluocinolone acetonide, hydroquinone, plus tretinoin). Azelaic acid

Table 3. *Qualitative Scarring Grading System by Goodman and Baron*[33]

Grade	Level	Clinical features
1	**Macular**	Erythematous, hyper- or hypopigmented flat marks (colour problem)
2	**Mild**	Atrophy or hypertrophy may not be obvious at social distances of ≥50 cm, covered by makeup or the shadow of shaved beard hair (men) or normal body hair
3	**Moderate**	Atrophic or hypertrophic scarring is obvious at social distances of ≥50 cm, not covered by makeup or the shadow of shaved beard hair (men) or normal body hair; atrophic scars can be flattened by manual stretching of the skin
4	**Severe**	Atrophic or hypertrophic scarring is evident at social distances of ≥50 cm; not covered by makeup or atrophic scars and not flattened by manual stretching of the skin

demonstrated improvement at 4 weeks with ongoing results at 16 weeks of application. Minor irritation can occur but unlike other options it is safe in pregnancy, or for patients who cannot tolerate retinoids.[36] Oral isotretinoin is effective at preventing PIH when used for concomitant severe acne scarring.[38] Chemical peels may be helpful such as Jessners and salicylic acid 30%.[49] Oral tranexamic acid may be useful to treat or prevent PIH.[39] Medical treatment may be used in combination with other modalities to enhance results.

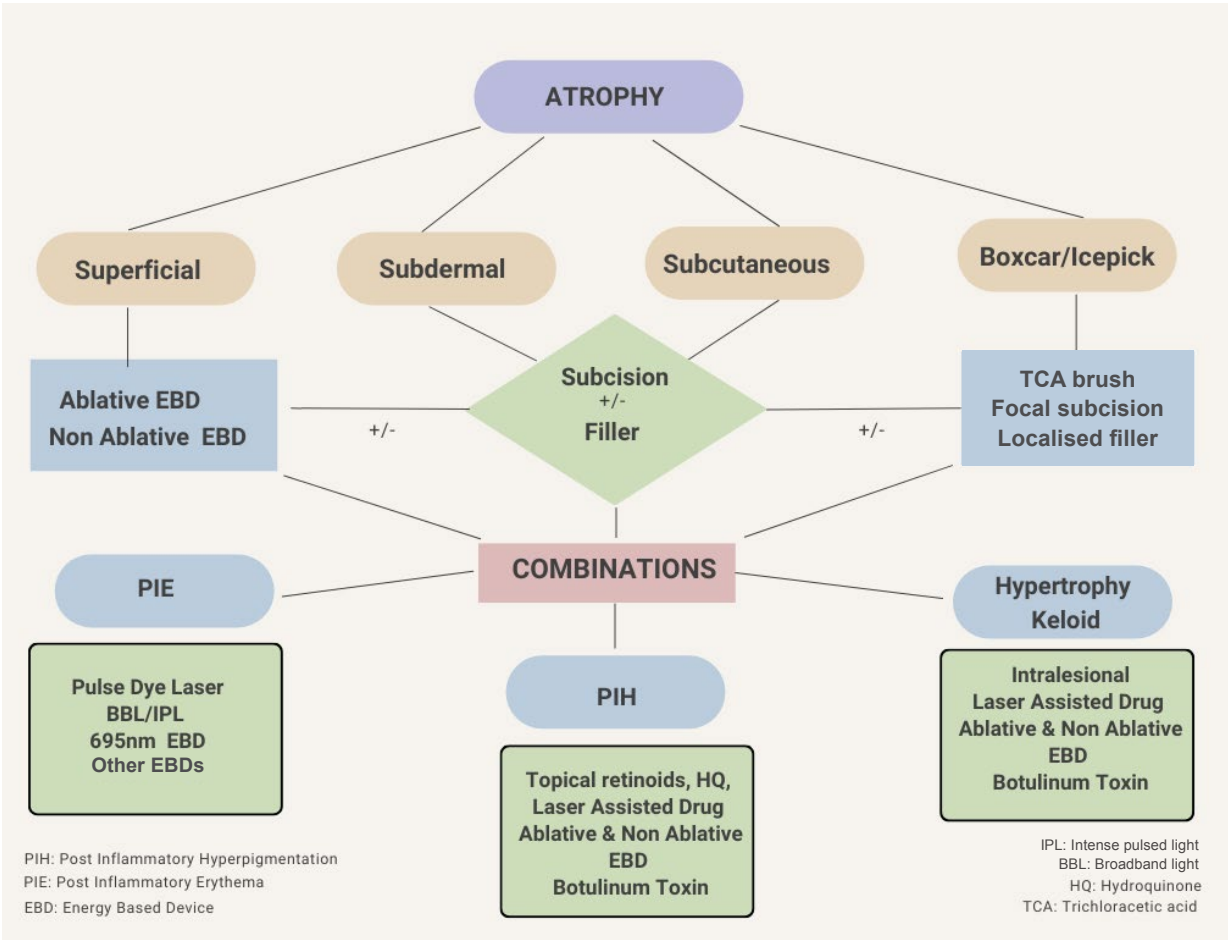
Step 4. Consider the patient's needs and complete the treatment plan

After completing the first steps, a flow chart (Figure 2) can help to determine the range of treatments to institute.

Choices are then altered according to downtime, acceptance of risk, travel cost or distance, ability to tolerate discomfort level and impacts of cost of treatment. For example, patients on a limited budget might consider treatments such as microneedling or radiofrequency. On the other hand, patients without monetary concerns can opt for fractionated lasers in combination with subcision, fillers, and CROSS combinations all within one session. The primary goal of the physician is to optimise a plan for each patient that works with their primary concerns and lifestyle factors. Finally, clinicians need to communicate to patients a realistic timeframe for results. In moderate to severe cases several sessions over an 18-month to 2-year period may be required. Patients need to appreciate that consistent maintenance treatments on an annual basis can help sustain and build on outcome given acne scarring may alter in appearance as the skin laxity develops with age.

Due to the lack of appropriate medical software systems specific to acne scarring, the authors have developed a manual treatment planning sheet that has worked effectively in their clinic (Appendix 1). This has assisted the administrative team to book treatment and the nursing team to prepare for treatments.

Figure 2. *Acne scarring treatment flow chart*



Limitations of single session multimodal therapy

With all processes there are advantages and disadvantages. The authors have explored the pros and cons of single session multimodal therapy in Table 4.

Table 4. *Advantages and disadvantages of single session multimodal acne scar rehabilitation*

Advantages	Disadvantages
Superior outcome	High learning curve
Higher patient satisfaction	Vast array of costly equipment required
Less cost overall for patient, but higher cost per treatment	Difficulty in measuring outcome
Less global downtime for patients	Multiple treatments still required, but less overall treatment sessions
	Procedural time for physicians (30-60 min)

The value and complexity of photographing acne scar patients

Photography before each treatment is essential to document patients' progress. However, photographically documenting acne scarring is challenging. Facial photography devices do not adequately document the topographic features and contour defects of atrophic scarring (Figures 3 and 4). Angled tangential light from above the patient highlights atrophy and textural change. Most standardised photo systems use directed illumination which causes scars to disappear. Colour imaging alone does not allow for volumetric assessment of the scar. Three-dimensional photographic imaging software can calculate volume but cannot effectively demonstrate erythema and dyschromia.[40] The Canfield 3D Primos can capture high-resolution 3D images to demonstrate fine surface details and can demonstrate objective measures of scar depth and volume.

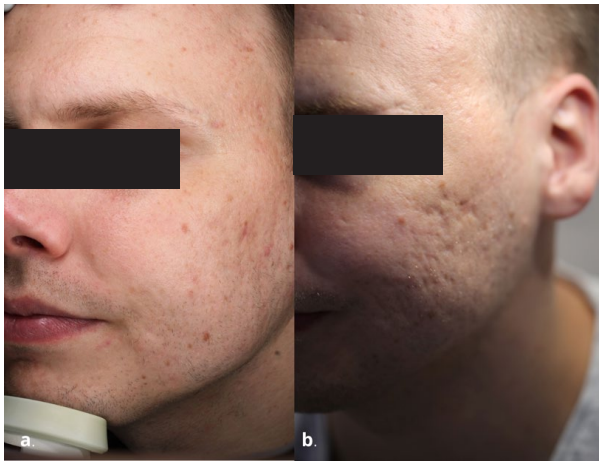


Figure 3. *The influence of lighting on photographic documentation of acne scarring. a. Visia standardised skin imaging. b. Digital SLR camera with light angled tangentially above the head*

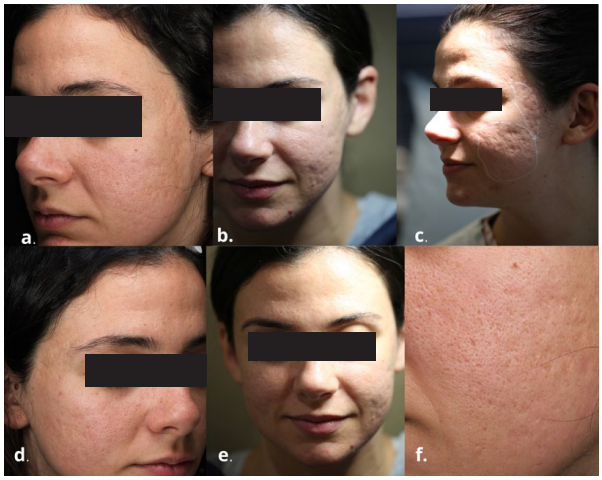


Figure 4. *Further demonstration of the influence of lighting on photographic documentation on acne scarring. a,d,f Canfield Visia imaging; b,c,e DSLR camera with light at different angles.*

Treatment execution

With an effective plan, clinical staff can adequately prepare each patient's treatment, so everything is readily available. Planning and prediction of the number of sessions ensures enough capacity in the working plan to perform treatments at desired intervals for patients. The authors have developed a treatment documentation sheet that has worked effectively in their clinic. In time, the use of an agreed upon universal global grading, planning and treatment documentation system for single session multimodal treatments may assist in improving the opportunity in the future to help categorise patients into severity and number of modalities per session. A quantitative and likely computerised 3D point scoring accounting for severity, volume and dyschromia would be ideal to determine effectiveness of single session multimodality treatment.

Figure 5. *Before and after photos courtesy Dr Jill Waibel*

Figure 6. *Before and after photos courtesy Dr Jill Waibel*

Conclusion

Single session customised multimodal acne scar rehabilitation offers patients more rapid results and outcomes with less total physical and personal downtime. Results that can be achieved are indicated in Figure 5 and 6. While it may seem like a high initial cost, fewer treatment visits may decrease time off work, commuting expenses, and overall financial cost of treatments over time. The infinite possible combinations of acne scar treatments make measuring the success of a single session multimodal treatment challenging. It is the authors' hope that this manuscript allows physicians to feel more comfortable in establishing a multimodal treatment plan in one visit, patient permitting.

References

1. Tan J, Chavda R, Leclerc M, Brigitte D. Projective Personification Approach to the Experience of People with Acne and Acne Scarring—Expressing the Unspoken. JAMA Dermatol 2022; 158(9):E1-E7.
2. Halvorsen JA, Stern RS, Dalgard F, Thoresen M, Bjertness E, Lien L. Suicidal ideation, mental health problems, and social impairment are increased in adolescents with acne: a population- based study. J Invest Dermatol. 2011;131:363-70.
3. Dreno BL, Bettoli V, Torres Lozada V, Kang S. Global Alliance to Improve Outcomes in Acne. Evaluation of the prevalence, risk factors, clinical characteristics, and burden of acne scars amongst active acne patients who consulted a dermatologist in Brazil, France and the USA. Present 23rd EADV Congr Amst Netherland. 2014; (P024).
4. Zaleski-Larsen LA, Fabi SG, McGraw T, Taylor M. Acne Scar Treatment: a multimodal approach tailored to scar type. Dermatol Surg. 2016; 139-49.
5. Goodman GJ, Postacne Scarring: A Review of its Pathophysiology and Treatment. Dermatol Surg 2000;26:857-71
6. Connolly D, Vu HL et al. Acne Scarring – Pathogenesis, Evaluation and Treatment Options. J Clin Aesthet Dermatol. 2017; 10(9): 12–23.
7. Fabbrocini G, Annunziata MC, D'Arco V, De Vita V, Lodi G, Mauriello MC, et al. Acne scars: pathogenesis, classification and treatment. Dermatol Res Pract. 2010;2010:893080.
8. Holland DB, Jeremy AHT, Roberts SG, Seukeran DC, Layton AM, Cunliffe WJ. Inflammation in acne scarring: a comparison of the responses in lesions from patients prone and not prone to scar. Br J Dermatol. 2004;150(1):72–81.
9. Layton AM, Henderson CA, Cunliffe WJ. A clinical evaluation of acne scarring and its incidence. Clin Exp Dermatol. 1994;19(4):303-8.
10. Baum CL, Arpey CJ. Normal cutaneous wound healing: clinical correlation with cellular and molecular events. Dermatol Surg. 2005;31(6):674–686.
11. Chivot M, Pawin H, Beylot C, Chosidow O, Dreno B, Faure M, et al. Cicatrices d'acné: épidémiologie, physiopathologie, clinique, traitement [Acne scars: epidemiology, physiopathology, clinical features and treatment]. Ann Dermatol Venereol. 2006;133(10):813-24.
12. ElAttar Y, Mourad B, Alngomy HA, Shams El Deen A, Ismail M. Study of interleukin-1 beta expression in acne vulgaris and acne scars. J Cosmet Dermatol. 2022 Feb 16. doi: 10.1111/jocd.14852. Epub ahead of print.
13. Alster TS, Tanzi EL. Hypertrophic scars and keloids: etiology and management. Am J Clin Dermatol. 2003;4(4):235-43.
14. Goodman GJ, Commentary on a Neglected Acne Scar Type: Papular Acne Scars and Their Correlations with Keloid Scars. Dermatol Surg. 2021;47(10):1352-3.
15. Taylor MB, Koron N. Combined Treatment of Rolling Acne Scars in Ethnic Skin Using Extensive Subcision, Trichloracetic Acid Peel, and Fractional Ablative Erbium Laser. Dermatol Surg. 2021;47(4):496.
16. Wang B, Wu Y, Luo YJ, Xu XG, Xu TH, Chen JZ, et al. Combination of intense pulsed light and fractional CO(2) laser treatments for patients with acne with inflammatory and scarring lesions. Clin Exp Dermatol. 2013;38(4):344-51.
17. Galal O, Tawfik AA, Abdalla N, Soliman M. Fractional CO2 laser versus combined platelet rich plasma and fractional CO2 laser in the treatment of acne scars. Image analysis system evaluation. J Cosmet Dermatol. 2019; 18. 1665-71.
18. Zhou BR, Zhang T, Bin Jameel AA, Xu Y, Xu Y, Guo SL, et al. The efficacy of conditioned media of adipose-derived stem cells combined with ablative carbon dioxide fractional resurfacing for atrophic acne scars and skin rejuventation. J Cosmet Laser Ther. 2016. 18: 138-48.
19. Cameli N, Mariano M, Serio M, Ardigo M. Preliminary comparison of fractional laser with fractional laser plus radiofrequency for the treatment of acne scars and photoaging. Dermatol Surg 2014;40:553-61.
20. Tenna S, Cogliandro A, Piombino L, Filoni A, Persichetti P. Combined use of fractional CO2 laser and radiofrequency waves to treat acne scars: a pilot study on 15 patients. J Cosmet Laser Ther. 2012;14(4):166-71.
21. Simmons BJ, Griffith RD, Falto-Aizpuruna LA, Nouri K. Use of radiofrequency in cosmetic dermatology: focus on nonablative treatment of acne scars. Clin Cosmet Investig Dermatol. 2014;7:335-9.
22. Asif M, Kanodia S, Singh K. Combined autologous platelet-rick plasma with microneedling versus microneedling with distilled water in the treatment of atrophic acne scars: a concurrent split face study. J Cosmet Dermatol 2016; 15: 434-43.

23. Biesman BS, Cohen JL, DiBernardo BE, Emer JJ, Geronemus RG, Gold MH, et al. Treatment of Atrophic Acne scars with Microneedling followed by polymethylmethacrylate Collagen gel Dermal filler. Dermatol Surg 2019; 45. 1570-9.

24. Faghini G, Poostiyan N, Asilian A, Abtahi-Naeini B, Shahbazi M, Iraji F, et al. Efficancy of fractionated microneedling radiofrequency with and without subcision for the treatment of atrophic facial scars: a randomised split faced clinical study. J Cosmet Dermatol 2017; 16:223-9.

26. Epstein RE, Spencer JM. Coreection of atrophic scars with ArteFill: an open- label pilot study. J Drugs Dermatol. 2010;9:1062-4.

27. Fulchiero GJ, Parham-Vetter PC, Obagi S. Subcision and 1320nm Nd:Yag nonablative laser resurfacing for the treatment of acne scars: a simultaneous split-face single patient trial. Dermatol Surg 2004; 30: 1356-9.

28. Alam M, Omura N, Kaminer MS. Subcision for acne scarring: technique and outcomes in 40 patients. Dermatol Surg 2005;31:310-7.

29. Ebrahim HM, Nassar A, Elkashishy K, Artima AYM, Morsi HM. A combined approach of subcision with either cross-linked hylauronic acid or threads in the treatment of Atrophic Acne Scars. J Coll Physicans Surg Pak. 2021; 31:55-9.

30. Nilforoushzadeh MA, Fakhim T, Heidari-Kharaji M, Hanifnia AR, Hejazi S, Torkamaniha E. Efficacy evaluation of Endolift based subcision on acne scar acne scar treatment. J Cosmet Dermatol 2021. 20: 2579-2582.

31. Deshmukh NS, Belgaumkar VA. Platelet-Rich Plasma augments Subcision in Atrophic Acne Scars. A Split Face comparative study. Dermatol Surg 2019; 45: 90-8.

32. Chilicka-Hebel K, Pagacz K. The use of combination therapy with 20% glycolic acid and fractional mesotherapy to reduce acne scars: a case report. Med Sci Pulse. 2019;13:49-51.

33. Goodman GJ, Baron JA. Postacne scarring- a quantitative global grading system. Dermatol Surg. 2006;32(12):1458-66.

34. Quiñonez RL, Agbai ON, Burgess CM, Taylor SC. An update on cosmetic procedures in people of color. Part 1: Scientific background, assessment, preprocedure preparation. J Am Acad Dermatol. 2022 Apr;86(4):715-25.

35. Callender VD, Baldwin H, Cook-Bolden FE, Alexis AF, Stein Gold L, Guenin E. Effects of Topical Retinoids on Acne and Post-inflammatory Hyperpigmentation in Patients with Skin of Color: A Clinical Review and Implications for Practice. Am J Clin Dermatol. 2022;23(1):69-81.

36. Kircik LH. Efficacy and safety of azelaic acid (AzA) gel 15% in the treatment of post-inflammatory hyperpigmentation and acne: a 16-week, baseline-controlled study. J Drugs Dermatol. 2011;10(6):586-90.

37. How KN, Lim PY, Wan Ahmad Kammal WSL, Shamsudin N. Efficacy and safety of Jessner's solution peel in comparison with salicylic acid 30% peel in the management of patients with acne vulgaris and postacne hyperpigmentation with skin of color: a randomized, double-blinded, split-face, controlled trial. Int J Dermatol. 2020;59(7):804-12.

38. Winhoven SM, Ahmed I, Owen CM, Lear JT. Postinflammatory hyperpigmentation in an Asian patient: a dramatic response to oral isotretinoin (13-cis-retinoic acid). Br J Dermatol. 2005;152(2):368-9.

39. Lindgren A, Austin AH, Welsh KM. The use of Tranexamic Acid to Prevent and Treat Post-Inflammatory Hyperpigmentation. J Drug Dermatol 2021; 20(3):344-5.

40. Clark A, Saric S, Sivamani R. Acne Scars: How do we grade them Am J of Clin Dermatol. 2018; 19(2): 139-44.

Appendix 1 – Treatment plan

Single Session Acne Scar Rehabilitation Treatment Plan

Patients Name: _____ **DOB:** _____

Practitioner/s: _____ **Date:** _____

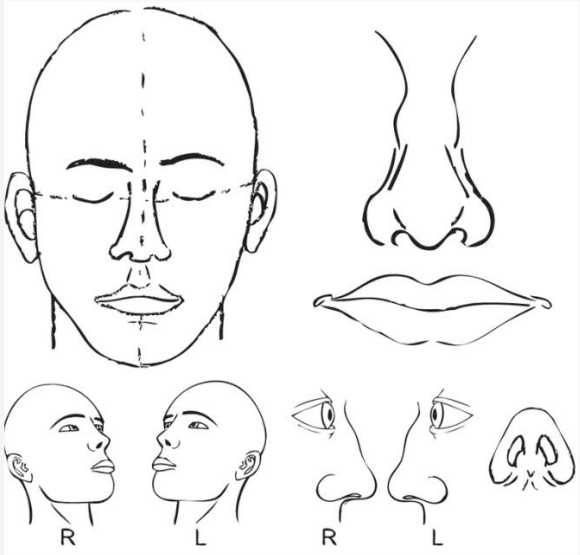
G & B Scar Grade

◯ 1a ◯ 1b
◯ 2a ◯ 2b
◯ 3a ◯ 3b
◯ 4a ◯ 4b

SCAR TYPES

◥ ICEPICK ✖ ATROPHIC DERMAL ▲ HYPERTROPHIC
■ BOX ✔ ATROPHIC SUB ◆ KELOID

SURFACE COLOUR ◯ Red ◯ Brown ◯ White



PATIENT FACTORS

	Mild	Moderate	Severe
Psychological impact:	◯	◯	◯
	Minimal	**Moderate**	**No Concern**
Downtime Available:	◯	◯	◯

ADDITIONAL PT INFO/NOTES

◯ Pre treatment photos taken
◯ Patient Information given
◯ Consent information given
◯ Quote received

APPOINTMENTS/INSTRUCTIONS

SKIN TYPE/CONCERNS/PASTRX

TREATMENT PLAN

(Circle which treatment)

SESSION 1

CO2 Erbium 1550nm 1927nm 595nm 1064nm BBL RF Pico QS

Subcision Microneedling TCA Cross % Filler Punch Elliptical TAC/ 5 FU Botulinum

Appt Length
TLA Y/N Time
Quote
Rx Interval

Filler Type/ Additional requests instruments

SESSION 2

CO2 Erbium 1550nm 1927nm 595nm 1064nm BBL RF Pico QS

Subcision Microneedling TCA Cross % Filler Punch Elliptical TAC/ 5 FU Botulinum

Appt Length
TLA Y/N Time
Quote
Rx Interval

Filler Type/ Additional requests instruments

SESSION 3

CO2 Erbium 1550nm 1927nm 595nm 1064nm BBL RF Pico QS

Subcision Microneedling TCA Cross % Filler Punch Elliptical TAC/ 5 FU Botulinum

Appt Length
TLA Y/N Time
Quote
Rx Interval

Filler Type/ Additional requests instruments

TLA- topical local anaesthetic