

Efficacy of a combination approach using subcision, fillers, and fractional carbon dioxide laser for the treatment of facial acne scars in Fitzpatrick skin types IV–VI

Rinky Kapoor MD¹  | Sapna Vadera MDS²  |
Debraj Shome MD, FRCS (Glasgow), FACS, FAACS, MBA³ 

¹Department of Dermatology, Cosmetic Dermatology & Dermato-Surgery & Director, The Esthetic Clinics, Mumbai, India

²Department of Facial Plastic & Facial Cosmetic Surgery, The Esthetic Clinics, Mumbai, India

³Department of Facial Plastic & Facial Cosmetic Surgery & Director, The Esthetic Clinics, Mumbai, India

Correspondence

Debraj Shome, MD, FRCS, FACS, MBA,
Department of Facial Plastic Surgery, The
Esthetic Clinics, The Esthetic Clinics, Mumbai,
400101, India.
Email: debraj.shome@theestheticclinic.com

Abstract

Introduction: Acne is one of the most common skin diseases, causing scars as a common and persistent complication. A single modality of treatment is not completely effective, and hence a combination of therapeutic modalities is required for the treatment. As the condition is very distressing in nature and leaves an impact at a psychological level, the patient often seeks quick results.

Aims: Efficacy of combined approach using subcision and fillers followed by fractional carbon dioxide laser for the treatment of facial acne scars in Fitzpatrick IV–VI skin types.

Methods: One hundred sixty-five patients with Fitzpatrick IV–VI skin types and Grades 2–4 acne scars, as per Goodman and Baron Acne Grading Scale, were enrolled. Subcision followed by hyaluronic acid filler was performed initially, followed by fractional carbon dioxide laser 2 weeks later. Standardized digital global photographs were obtained before treatment, before every laser session, and 6 months after the last laser session.

Results: Using Goodman and Baron's Global Acne Scarring System, the patients showed significant improvement of both clinician and subjective scores in all grades of acne scars. No significant adverse events were noted.

Conclusion: To the best of our knowledge, this is the first study to date which involves the combined approach of subcision and fillers, followed by fractional carbon dioxide laser sessions for the treatment of acne scars. The results show significant and persistent improvement, without considerable complications, in Fitzpatrick's skin types IV–VI. This protocol should thus be considered for the management of acne scars of the face.

KEYWORDS

acne scar correction, acne scar protocol, acne scar treatment, dermal fillers for acne, fractional CO₂ laser, subcision

1 | INTRODUCTION

Acne is one of the most common skin diseases, causing scars as a common and persistent complication. Treating facial scarring, post-acne, is always challenging. A single modality of treatment is not completely effective and hence the combination of therapeutic modalities is required for the treatment.¹ As the condition is very distressing in nature and leaves an impact at a psychological level, the patient often seeks quick results.

Various procedures including noninvasive modalities like topical retinoids, microneedling, chemical peels, microdermabrasion, fractional lasers, and invasive modalities such as ablative lasers and acne scar surgeries have been used and recommended, with varied outcomes.^{2,3}

This study evaluates the clinical assessment of efficacy and therapeutic response of facial acne scars post a combination treatment protocol consisting of subcision and filler injections, followed by multiple sittings of fractional carbon dioxide laser—the rationale behind using this combination treatment being their synergistic action.

Subcision, can be safely combined with other procedures to treat depressed acne scars. The connection between the superficial and the deeper tissues gets released and subsequently the scar gets lifted, during the normal course of wound healing.⁴ Thereafter, hyaluronic acid fillers (HAF) are injected at the same sitting, which further raise the scar and more importantly avoid the reattachment of the fibrous strands back to the deeper tissues. By doing so, the scar is raised to the same level as that of the surrounding skin, thereby allowing fractional carbon dioxide laser to easily target the deeper atrophic pits of the acne scars, which are otherwise difficult to target. Fractional carbon dioxide laser, which works on the principle of ablation, shows its effect on the superficial layers of the skin. It works by causing immediate collagen formation and subsequent remodeling, ultimately leading to the improvement in the quality of the skin. Altogether, it reduces the depth of scarring and contributes immensely toward the clinical benefits in the scarred skin.⁴

Although subcision, fillers, and fractional carbon dioxide laser are quite frequently used for the treatment of acne scars, a combination of the above-mentioned minimally invasive modalities is not mentioned in the literature. This technique can significantly improve results by releasing a depressed scar from the underlying tissue, enhancing collagen induction, and resurfacing the skin, leading to skin with a more uniformly even texture.

2 | METHODS

The study was carried out from February 2015 to July 2017. One hundred sixty-five patients (90 females and 75 males) in the age range of 20–45 years (Table 1) with acne scars (Grades 2–4), as per Goodman and Baron Acne Grading Scale (grading of scars has been mentioned in Table 2) were enrolled in the study. The sample size was calculated through the standardized protocol of a priori power analysis using the G*Power Software based on the epidemiological prevalence data of facial acne in the Indian population, as reported by Kubba et al.^{5,6} Based on the a priori analysis, the sample size derived was 165, setting the alpha (α)-error at 5% and the statistical power of the study ($1-\beta$) to 80%. Prior clearance was obtained from the Institutional Ethical Committee. Clinical history and patient informed consents were obtained before treatment.

2.1 | Inclusion and exclusion criteria

Patients with Fitzpatrick IV–VI skin types and Grades 2–4 atrophic acne scars were included in the study. Patients taking isotretinoin (or having taken any time in the past 6 months), patients having active acne or keloidal tendency, patients having a history of herpes labialis, pregnant and lactating females, patients on whom prior procedures were performed for acne scars and patients with unrealistic expectations were excluded from the study.

2.2 | Assessment

Global standard photographs were taken with the Nikon DSLR camera in a special room assigned for global photography, under standardized lighting conditions.

2.3 | Evaluation

Objective assessment was performed by three blinded dermatologists, using comparative photographs, to grade the severity of scarring as per the grading system proposed by Goodman and Baron (Table 2),⁷ at baseline, before subcision and fillers, 2 weeks after subcision and fillers (i.e., just before the first fractional carbon dioxide laser session), before performing every fractional carbon dioxide laser session and thereafter 6 weeks and 6 months after the last laser session.

Participants distribution, N = 165	Age range (years)	N (%)	Age, Mean \pm SD	BMI, Mean \pm SD
Gender				
Female	20–45	90 (54.54%)	28.4 \pm 1.25	21.69 \pm 2.19
Male	20–45	75 (45.46%)	30.76 \pm 2.36	23.7 \pm 1.64

TABLE 1 Demographic data of the patients for the study

TABLE 2 Showing Goodman and Baron Grading Scale

Grade	Level of disease	Characteristics	Example of scars
1	Macular disease	Erythematous, hyper- or hypopigmented flat marks visible to patient or observer irrespective of distance.	Erythematous, hyper- or hypopigmented flat marks
2	Mild disease	Mild atrophy or hypertrophy that may not be obvious at social distances of 50 cm or greater and may be covered adequately by makeup or the normal shadow of shaved beard hair in males or normal body hair if extrafacial.	Mild rolling, small soft papular
3	Moderate disease	Moderate atrophic or hypertrophic scarring that is obvious at social distances of 50 cm or greater and is not covered easily by makeup 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.	More significant rolling, shallow "box car," mild to moderate hypertrophic or papular scars
4	Severe disease	Severe atrophic or hypertrophic scarring that is obvious at social distances of 50 cm or greater and is not covered easily by makeup 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.	Punched out atrophic (deep "box car"), "ice pick," bridges and tunnels, gross atrophy, dystrophic scars significant hypertrophy, or keloid

At the end of the study (6 months after the last laser session), patients were requested to fill a preformed questionnaire, wherein they were asked to rate the improvement of their scars on a 10-point scale (Table 3). Rating between 6 and 10 was considered as an "excellent response," rating between 4 and 6 as "good response" and rating below 4 was graded as "poor response." Adverse effects were also assessed both by the patients and the investigators, at all the follow-up periods. Statistical analyses were performed with SPSS software (SPSS 15.0; SPSS, Inc.), and $p < 0.05$ was considered as statistically significant.

2.4 | Methodology

Before starting the procedure, the face was cleaned and then degreased with acetone. A thick layer of topical anesthesia (a mixture of lignocaine 2% and prilocaine 2% cream) was applied for a duration of 30–45 min. Subcision was performed at the dermal-subcutaneous junction, using a 26 gauge needle. Multiple entry points were made on each side of the face, for scars on the lateral cheeks, upper lateral neck, temple, and lateral forehead. The needle was moved back and forth sideways, thereby breaking the fibrotic strands. Pressure hemostasis was applied to control the associated bleeding.

TABLE 3 Showing patients' self-assessment questionnaire

Is there an improvement in acne scars	Yes/no If yes, how much would you grade on a scale of 0–10
Rating above 6	Excellent response
Rating between 4 and 6	Good response
Rating below 4	Poor response

Immediately after this, the face was first cleansed with alcohol swabs and then with sterile normal saline. Hyaluronic acid filler was then injected under each marked pitted scar. Juvederm Voluma® XC (20 mg/ml; Allergan, Inc.) was used for the same. The target location for the filler was the deep dermis, with needle level parallel to the skin surface and facing upwards, injecting 0.02 ml of the filler, with a gradual retrograde injection technique, as the needle was withdrawn.

After a standardized duration of 2 weeks, post-subcision and fillers, the scars were reviewed and grading was reassessed, and the first session of fractional carbon dioxide laser (10,600 nm wavelength; Essato) was performed. To ensure minimum pain during the fractional carbon dioxide laser session, topical anesthesia was applied 45 min before treatment. When performing laser, the patient's face was turned to one side and the handpiece of the laser was moved to place a series of shots at the center as well as the edge of the scar. Additional passes were made when required. All the scars were treated individually in a similar fashion. Thereafter, a single pass was made on the entire zone of the face, affected with scarring, at lower power settings.

Treatment parameters for laser ranged from 25 to 30 W with a dwell time of 900–1100 μ s and dot spacing of 700–900 μ s. Each session of fractional carbon dioxide laser was performed at an interval of 6 weeks. The number of treatment sessions was standardized based on the severity of the acne scars. For patients with Grades 2, 3, and 4 scars, the number of laser sessions was standardized to 4, 7, and 10 sessions, respectively. Immediately, post-procedure, cold compresses were applied to the faces of all patients. It was followed by application of 1% hydrocortisone ointment twice a day and moisturizer for 1 week.

To evaluate the after-effects of the laser procedure, all patients were evaluated at Days 2, 7, and 14 post-first laser session. Sunscreen and strict photo-protection was advised to all patients. Improvement was reassessed on the basis of clinical assessment and photographs.

TABLE 4 Showing number of patients with various types of Fitzpatrick's skin color

Fitzpatrick's skin type	Number of patients (% distribution)
2	4 (2.42%)
3	25 (15.15%)
4	100 (60.61%)
5	36 (21.82%)

2.5 | Data collection and statistical analysis

All the collected data were stored in the Microsoft Excel version 2003, GraphPad Prism v.6 software, manufactured by company California Corporation. Data were checked for normality test before choosing statistical tests and it was found to be parametric. One-way analysis of variance (ANOVA) test and Pearson correlation tests were used.

3 | RESULTS

A total of 165 patients were enrolled in this study. Out of these, 15 patients dropped out of the study as they were not available for fractional carbon dioxide laser sessions. The age of the patients was in the range of 18–47 years with a mean age of 28.9 years.

The duration of acne scars was in the range of 1–25 years, with a mean duration of 8.9 years. The skin type of maximum patients as per Fitzpatrick was skin type IV. One hundred patients (60.61%) had Fitzpatrick type IV skin (Table 4). Of the various types of atrophic acne scars (ice pick, boxcar, depressed, rolled, and mixed), mixed scars were the commonest among patients. Sixty-seven patients (44.6%) were presented with mixed types of acne scars (Table 5). Based on the grading of acne, at the baseline, 8.66%, 34.66%, and 56.6% of patients had Grades 2, 3, and 4 acne scars, respectively (Table 6).

Table 7 and Figure 1 shows the objective improvement in the grading of scars assessed by the clinician. This was performed by one-way ANOVA analysis. It shows significant results in the improvement of acne scars from baseline ($p < .0001$). Out of 85 with Grade 4 acne scars, two patients showed a reduction in acne scars by three grades, 70 patients showed a reduction in acne scars by two grades and 13 patients showed a reduction in acne scars by one grade. Out of the 52 patients with Grade 3 acne, 40 patients showed a reduction by Grade 2, and 12 patients showed a reduction by Grade 1. Thirteen patients were reported with

TABLE 5 Showing number of patients with baseline morphology of atrophic scars

Types of acne scars	Number of patients (% distribution)
Mixed	67 (44.6%)
Ice pick	46 (30.66%)
Boxcar	18 (12%)
Rolled	19 (12.66%)

TABLE 6 Showing number of patients with baseline grading of atrophic scars

Baseline grade of acne scar	Number of patients (% distribution)
Grade 4	85 (56.66%)
Grade 3	52 (34.66%)
Grade 2	13 (8.66%)

Grade 2 acne, out of which three patients had a reduction in acne by two grades and 10 patients had reduction in acne by one grade.

Table 8 and Figure 2 shows the subjective improvement in the grading of acne scars as assessed by patients. Statistical analysis was performed and the Pearson correlation coefficient test was performed which showed positive correlation and significant results ($r = +.99$ excellent, $r = +.83$, $r = +.74$) and $p < 0.005$. Out of 150 patients, 122 patients showed excellent response, whereas 28 patients were presented with good response. None of the patients were reported with poor response.

No serious side effects were seen during the course treatments except for erythema, edema, oozing, and crusting, which was seen in almost all patients, after each fractional carbon dioxide laser session. This usually resolved within 7 days. Post-inflammatory hyperpigmentation (PIH) was seen in seven patients, which was transient in duration and resolved within a couple of weeks. No adverse events like infection, hypopigmentation, or worsening of scars were seen in any patient.

Figures 3–5 show the pre- and post-procedure images of patient 1 with Grade 3 acne, which showed improvement by two grades. Figures 6–8 show the pre- and post-procedure images of patient 1 with Grade 4 acne, which showed improvement by two grades.

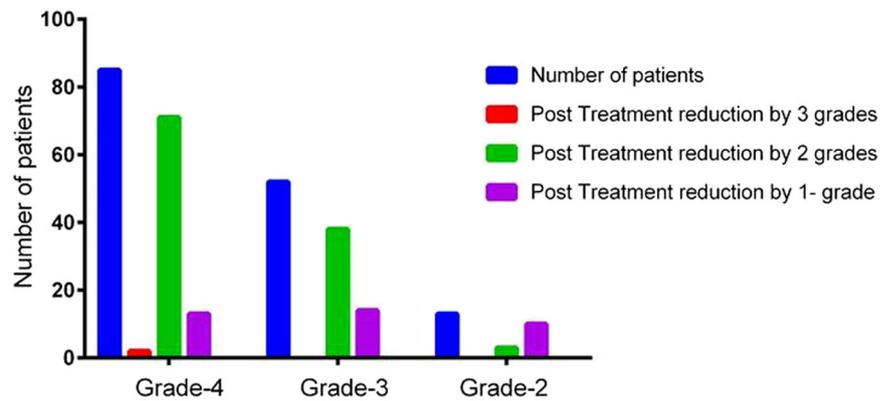
4 | DISCUSSION

Scarring post-acne is a complex process. The patients with acne scarring have a more pronounced basic inflammatory mechanism.⁸ There is an aberrant remodeling of the extracellular matrix (ECM) in pilosebaceous units of skin. Gram-positive bacteria including *Propionibacterium* acne increase the formation of matrix metalloproteinase-2 in sebocytes and skin fibroblasts, which in turn contributes to a distorted degradation of

TABLE 7 Showing the objective improvement in grading of acne scars assessed by the clinician

Grades	Number of patients		
	Posttreatment reduction by Grade 3	Posttreatment reduction by Grade 2	Posttreatment reduction by Grade 1
Grade 4	2	70	13
Grade 3	0	40	12
Grade 2	0	3	10

FIGURE 1 Showing the objective improvement in grading of acne scars assessed by the clinician



ECM.⁹ Additionally, production of prostaglandin E2 is enhanced by the peptidoglycans of Gram-positive bacteria.

Effective control of inflammation is a prime concern in acne scar management to prevent scarring. The treatment regimen for acne scars includes different procedures including but not limited to microneedling, chemical peels, subcision, and laser therapy.

In our protocol, subcision was the first step. It was first described by Orentreich in 1995,¹⁰ as a subcutaneous incisionless option for the treatment of atrophic scars. Its main action is the separation of the papillary dermis from the binding connections of the deeper tissues, subsequently lifting the scar during the course of normal wound healing.¹⁰ It ruptures the fibrotic tissue initiating an inflammatory reaction, which in turn culminates the production of collagen. Different needles with unique characteristics have been used for performing subcision, including 19–26 G.¹⁰ Nilforoush-zadeh et al.,¹¹ in their study on patients with acne scars performed the subcision procedure on a total of eight patients using cannulae numbers 18 and 21 for two sessions the objective assessment regarding the treatment outcome was done by a blinded dermatologist. Around 88% of patients showed improvement and were satisfied with the treatment results.

Another study was conducted by Al-Dhalimi and Arnoos,¹² which showed adverse effects such as edemas, hematomas, pain, PIH, and fibrotic nodules which were observed immediately after the procedure of subcision. In our study, the common side effects seen after subcision and fillers treatment were edema, pain, bruising which lasted for a transient duration of 3–10 days in most of the patients.

A split-face study was carried out by Balighi et al.¹³ on 20 patients. All of these patients underwent subcision with an 18-gauge

needle on one side of the face and subcision in conjunction with insertion of a subdermal implant on the other side of the face. At 6 months follow-up, on the side with subcision, 10% patients had no improvement, and 70% and 20% patients showed mild and moderate improvement, respectively. On the side with subcision and implant, 15%, 75%, and 10% patients had no improvement, mild improvement, and moderate improvement, respectively.

In our study, immediately after treatment with subcision, Juvederm Voluma® XC was injected. Fillers differ a lot in their cross-linking method, percentage of cross-linking, viscosity, cohesiveness, hardness, HA concentration, amount of HA and bound water, gel-to-fluid ratio, degree of HA modification, modulus, particle size (for biphasic HAF), ease of injection, and indications.¹⁴ All these factors contribute toward the versatility of fillers for the treatment of various conditions. Injection of fillers leads to collagen production by stimulation of the fibroblasts, resulting in soft-tissue augmentation.

Few studies mention the use of dermal fillers in the treatment of acne scars. Although, there is evidence supporting the use of poly-L-lactic acid and hyaluronic acid fillers for the treatment of acne scars, nothing concrete has been mentioned about the use of polyacrylamide and polyalkylimide fillers.¹⁴

Goodman and Van Den Broek¹⁵ conducted a study on five patients with atrophic acne scarring using HAF. The same was administered using the modified tower technique. The mean scar count reduced from 48.8 as baseline grading to 41.8 2 weeks post-HAF injections to 15.4 after two sessions. Improvement was noted from a pretreatment mean grading of 3.2 to 3.0 after one treatment, which further improved to 2.6, 1 month after the second treatment.¹⁵

In our protocol, fractional carbon dioxide lasers were performed after a standardized duration of 2 weeks post-subcision and fillers. With the advancement in the laser-resurfacing industry, multiple lasers including ablative, non-ablative, and fractional laser technologies have been introduced. It has been noted that the incidence of side effects is more with use, especially in individuals with darker skin types. Non-ablative technologies showed fewer side effects with limitations in terms of results being mild and slow. Fractional laser technology has gained huge popularity owing to its safety profile, reduced recovery time, and marked clinical outcome.¹⁶ Fractional

TABLE 8 Showing the subjective improvement in the grading of acne scars as assessed by patients

Grades	Number of patients		
	Patient with excellent response	Patient with good response	Patient with poor response
Grade 4	70	15	0
Grade 3	42	10	0
Grade 2	10	3	0

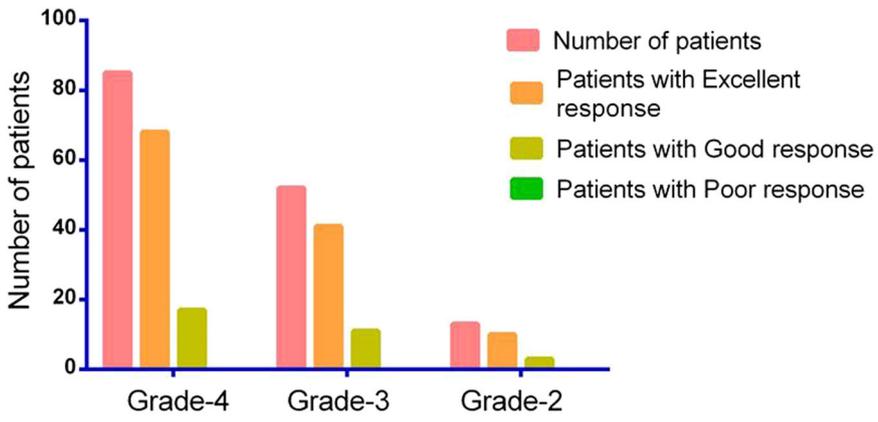


FIGURE 2 Showing the subjective improvement in the grading of acne scars as assessed by patients



FIGURE 3 Before and after procedure image of patient 1 with Grade 3 acne, which showed improvement by two grades



FIGURE 4 Before and after procedure image of patient 1 with Grade 3 acne, which showed improvement by two grades (left lateral view)

FIGURE 5 Before and after procedure image of patient 1 with Grade 3 acne, which showed improvement by two grades (right lateral view)



carbon dioxide laser is efficacious and is very commonly used for the treatment of acne scars.

The mechanism of action of fractional carbon dioxide laser is thermal ablation of the microscopic columns of epidermal and dermal tissue of the skin surface in regularly spaced arrays over a fraction. The formation of new collagen is promoted by resurfacing the epidermis and heating the dermis at the same time.¹⁷ Apart from being more effective than non-ablative resurfacing, it also provides a faster recovery compared to other resurfacing modalities. All three approaches are different from each other with respect to the amount of thermal damage, efficacy, side effects, and downtime.

Immediate effects of the fractional carbon dioxide laser procedure included serosanguineous oozing, punctuate bleeding, mild to moderate erythema, in all subjects. Serosanguineous oozing and

bleeding were transient and resolved in 24–48 h following treatment. Erythema and edema were also transient and resolved completely in the majority of subjects within 1 month. Three cases of PIH were reported, which resolved on their own. All these patients had a Fitzpatrick skin types IV–VI. Incidence of PIH can be decreased by using lower treatment densities and applying topical hydroquinone before and after the laser session.

Hasegawa et al did a study involving the treatment of acne scarring with the use of fractional carbon dioxide laser in Asian skin as a standalone treatment modality. It showed excellent, good, fair, and poor response in 6.5%, 29%, 35.5%, and 29% patients, respectively.¹⁶ In a similar study conducted by Zhang et al., using fractional carbon dioxide laser, 66.4%, 30%, 3.7%, and 0.9% patients reported Grades 1, 2, 3, and 4 improvements, respectively.¹⁸



FIGURE 6 Before and after procedure image of patient 2 with Grade 4 acne, which showed improvement by two grades



Before



After

FIGURE 7 Before and after procedure image of patient 2 with Grade 4 acne, which showed improvement by two grades (left lateral view)



Before



After

FIGURE 8 Before and after procedure image of patient 2 with Grade 4 acne, which showed improvement by two grades (right lateral view)

The current study shows far superior results in comparison to the aforementioned studies which involve the use of a single modality for the treatment of acne scars. Given our targeted and specific work in pigmented skin, especially in Asian Indians, this paper is another one which brings across and showcases how the relevant expertise and specific modality based protocols can impact and transform problems in pigmented skins effectively.¹⁹⁻²³

5 | CONCLUSION

To the best of our knowledge, this is the first study to date which involves the combined approach of subcision and fillers, followed by

fractional carbon dioxide laser sessions for the treatment of acne scars.

We can suggest that using this combination approach of subcision and fillers followed by fractional carbon dioxide laser, the efficacy of treatment can be remarkably increased. The results show significant and persistent improvement, without considerable complications, in Fitzpatrick's skin types IV-VI. Hence, this protocol should be considered worthwhile to treat depressed acne scars of the face.

ACKNOWLEDGMENTS

Manuscript writing: Rinky Kapoor and Sapna Vadera. *Conceptualization:* Debraj Shome.

CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

ORCID

Rinky Kapoor  <https://orcid.org/0000-0003-1513-0265>

Sapna Vadera  <https://orcid.org/0000-0001-9221-5006>

Debraj Shome  <https://orcid.org/0000-0003-2163-1170>

REFERENCES

- Anupama YG, Wahab AJ. Effectiveness of CO₂ laser with subcision in patients with acne scars. *J Cosmet Laser Ther.* 2016;7:367-371.
- Rivera AE. Acne scarring: a review and current treatment modalities. *J Am Acad Dermatol.* 2008;59(4):659-676.
- Elizabeth L, Tanzi, Tina S, Alster TS. Treatment of atrophic facial acne scars with a dual-mode Er:YAG laser. *Dermatol Surg.* 2002;28:551-555.
- Faghihi G, Poostiyan N, Asilian A, et al. Efficacy of fractionated micro-needle radiofrequency with and without adding subcision for the treatment of atrophic facial acne scars: a randomized split-face clinical study. *J Cosmet Dermatol.* 2017;16:223-229.
- Kubba R, Bajaj AK, Thappa DM, et al. Epidemiology of acne. *Indian J Dermatol Venereol Leprol.* 2009;75:32-34.
- Faul F, Erdfelder E, Lang AG, Buchner A. G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior research methods.* 2007 May 1;39(2):175-91. *Behavior research methods.* 2007;39(2):175-91.
- Goodman GJ, Baron JA. Postacne scarring: a qualitative global scarring grading system. *Dermatol Surg.* 2006;32:1458-1466.
- Goodman GJ. Post-acne scarring: a short review of its pathophysiology. *Australas J Dermatol.* 2001;42:84-90.
- Abdel Hay R, Shalaby K, Zaher H, et al. Interventions for acne scars. *Cochrane Database Syst Rev.* 2016;4:CD011946.
- David S, Orentreich DS, Orentreich N. Subcutaneous incisionless (subcision) surgery for the correction of depressed scars and wrinkles. *Dermatol Surg.* 1995;21:543-549.
- Nilforoushzadeh M, Lotfi E, Nickkholgh E, Salehi B, Shokrani M. Can subcision with the cannula be an acceptable alternative method in treatment of acne scars? *Med Arch.* 2015;69:384-394.
- Al-Dhalimi MA, Arnoos AA. Subcision for treatment of rolling acne scars in Iraqi patients: a clinical study. *J Cosmet Dermatol.* 2012;11:144-150.
- Balighi K, Robati RM, Moslehi H, Robati AM. Subcision in acne scar with and without subdermal implant: a clinical trial. *J Eur Acad Dermatol Venereol.* 2008;22:707-711.
- Forbat E, Ali FR, Al-Niaimi F. The role of fillers in the management of acne scars. *Clin Exp Dermatol.* 2017;42:374-380.
- Goodman GJ, Van Den Broek A. The modified tower vertical filler technique for the treatment of post-acne scarring. *Australas J Dermatol.* 2016;57:19-23.
- Hasegawa T, Matsukura T, Mizuno Y, Suga Y, Ogawa H, Ikeda S. Clinical trial of a laser device called fractional photothermolysis system for acne scars. *J Dermatol.* 2006;33:623-627.
- Alexiades-Armenakas MR, Dover JS, Arndt KA. The spectrum of laser skin resurfacing: nonablative, fractional, and ablative laser resurfacing. *J Am Acad Dermatol.* 2008;58:719-737.
- Zhang Z, Fei Y, Chen X, Lu W, Chen J. Comparison of a fractional microplasma radio frequency technology and carbon dioxide fractional laser for the treatment of atrophic acne scars: a randomized split-face clinical study. *Dermatol Surg.* 2013;39:559-566.
- Shome D, Vadera S, Khare S, Ram MS, Ayyar A, Kapoor R, Desai N. Aging and the Indian face: an analytical study of aging in the Asian Indian face. *Plastic and Reconstructive Surgery Global Open.* 2020;8(3).
- Shome D, Vadera S, Ram MS, Khare S, Kapoor R. Use of micro-focused ultrasound for Skin Tightening of Mid and Lower Face. *Plastic and Reconstructive Surgery Global Open.* 2019 Dec;7(12).
- Shome D, Vadera S, Shiva Ram M, Kapoor R. Efficacy of Incobotulinum toxin-A for the treatment of masseter muscle hypertrophy in Asian Indian patients: A 2-year follow-up study. *Journal of Cosmetic Dermatology.* 2020 Aug;19(8):1892-9.
- Shome D, Vadera S, Male SR, Kapoor R. Does taking selfies lead to increased desire to undergo cosmetic surgery. *Journal of cosmetic dermatology.* (2020 Aug;19(8):2025-32.
- Shome D, Vadera S, Kapoor R. Reply: Efficacy of Botulinum Toxin in Treating Asian Indian Patients with Masseter Hypertrophy: A 4-Year Follow-Up Study. *Plastic and Reconstructive Surgery.* 2020 Jun 1;145(6):1105e-6e.

How to cite this article: Kapoor R, Vadera S, Shome D. Efficacy of a combination approach using subcision, fillers, and fractional carbon dioxide laser for the treatment of facial acne scars in Fitzpatrick skin types IV–VI. *Dermatological Reviews.* 2021;1-9. <https://doi.org/10.1002/der2.53>