



## "Scar Wars: Manual Dermabrasion Vs. Fractional Co2 Laser - A Battle of Resurfacing Techniques"

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### KEYWORDS

Post surgical Scar, Fractional Co2 Laser, Manual Dermabrasion, Patient acceptance

### ABSTRACT:

**Background:** The study aims to compare the effectiveness of scar resurfacing using manual dermabrasion versus fractional CO2 laser treatment for post-surgical scars. The comparison focuses on various parameters, including pain, discomfort, edema, hyperpigmentation, eschar formation, safety, and patient acceptance.

**Material and Methods:** A total of 60 patients were randomly assigned to two groups of 30 each. Group 1 received treatment through manual dermabrasion, while Group 2 underwent fractional CO2 laser treatment.

**Results:** Patients were evaluated postoperatively at 1, 3, and 6 months for pain, edema, hyperpigmentation, and eschar formation.

**Conclusion:** The study concludes that both techniques are effective for scar resurfacing; however, statistical analysis indicates that fractional CO2 laser resurfacing is more effective than manual dermabrasion in treating post-surgical scars.

### INTRODUCTION

The Greek word "eskhara" is where the word "scar" comes from. It was first used in English in the fourteenth century. Any mark or imperfection left over after a burn, wound, sore, or other ailment has healed is called a scar. When fibrous tissue replaces the regular skin during the wound-healing process, scars naturally develop.

But this scar tissue is not the same as skin that is not injured. 4.5% to 16% of people in the general population have scars. Scars can significantly impact a patient's mental health, potentially leading to issues such as low self-esteem and social isolation, depending on the severity of the deformity.[1]

Patients may experience severe psychological distress as a result of facial scars, particularly if the scar was left



behind after a tumour was surgically removed.[2] Laser scar correction can be conducted either as a single therapy or in conjunction with other scar therapies. It is a safe technique with few adverse effects that has been shown to be successful in clinical trials.[3]

Many techniques for improving scars have been developed over the past 20 years, including dermabrasion, chemical peels, electrosurgical planing, intralesional injections, surgical scar removal, and filler implantation. But a lot of individuals who want to make cosmetic changes are afraid of surgery and would rather use non-surgical, less invasive methods like dermabrasion.

The main objective of any scar resurfacing technique is to make the scar region as smooth as possible so that it melds in perfectly with the surrounding skin. The epidermis on top of it and some of the superficial dermis (papillary dermis) are removed to accomplish this.[4]

Since its original description in the early 20th century, ablative resurfacing techniques using dermabrasion have long been regarded as the traditional, gold standard.[5] Dermabrasion is a mechanical resurfacing technique that involves applying a diamond fraise or quickly spinning wire brush to the skin. The operator of this expert procedure must precisely gauge the depth of skin that requires resurfacing.[4]

Dermarollers are becoming more and more well-liked as an easy way to heal scars, especially acne-related scars. Dermatologists can safely use them in clinics even with limited training. A typical dermaroller has a drum-shaped roller with eight rows of 192 tiny microneedles, each measuring 0.1 mm in diameter and 0.5 to 1.5 mm in length. The instrument is presterilized by gamma irradiation. Medical dermarollers are meant to be used just once.[6]

Early laser intervention has become known as a cutting-edge method for enhancing scar quality in recent years. Some lasers work well not just to cure pre-existing scars but also to stop hypertrophic scars from forming.[7] The CO<sub>2</sub> laser was one of the earliest laser systems, initially developed in 1964 by Patel and associates at Bell Laboratories in the United States. Its high water absorption made it quickly recognized as an ideal surgical laser, and the late Professor Isaac Kaplan,

among others, was a pioneer in exploring its various applications.[8] When carbon dioxide (CO<sub>2</sub>) lasers were developed in the 1980s, ablative resurfacing could be successfully completed.

As laser technology developed in the 1980s, ablative resurfacing was successfully achieved with CO<sub>2</sub> and other lasers. On the other hand, dermabrasion often showed great, if not better, outcomes than laser treatments in head-to-head examinations.[9]

In response to the increasing need for skin resurfacing that is both safer and more effective, fractional laser therapy was created. In order to combine the improved efficacy of evenly ablative laser remodelling methods with a safer method, fractional resurfacing was established.[10]

The aim of this study is to compare the effectiveness of scar resurfacing using manual dermabrasion versus fractional CO<sub>2</sub> laser in the treatment of post-surgical scars.

## Material and Methods

The participants were informed about the study and provided their consent by signing an informed consent form. Ethical clearance was secured before the study began. Each patient underwent a thorough evaluation, which included a detailed medical history, general physical examination, systemic examination, and dermatological assessment.

The inclusion criteria were : Patient with scars of Type I,II,III, IV according to Fitzpatrick classification. Patient having Scar of more than 2 cm long. Patient who is willing to undergo the procedure. Patient of age ranging from 18 – 45 years. Preoperatively, all patients were informed about the surgical procedure, postoperative instructions, possible complications and written consent was taken. Routine investigations were carried out which includes Complete blood count, Bleeding and Clotting time, Prothrombin time and Viral markers.

CO<sub>2</sub> laser (Fig 1) was used, with a fluence of 40 mJ and with a wavelength of 10,600 nm. Laser were passed from all the directions. Bacitracin ointment was applied to the treated areas, which were then covered with nonstick gauze. Following the procedure, patients were provided



with a visual analog scale to separately rate the pain and discomfort they experienced during each treatment.



Fig no: 1  
Fractional  
Co2 Laser



Fig no: 2 Manual Dermaroller

A standard dermaroller (Fig 2) was applied to the area marked with gentian violet, reaching down to the dermal-epidermal junction. Dermabrasion was carried out until a consistent area of pinpoint bleeding was observed, with the edges blended seamlessly into the surrounding epidermis.

Bacitracin ointment was then applied, and patients were prescribed prophylactic antibiotics and antiviral medication as previously mentioned. Patients were asked to return for follow-up visits at 1 month, and 3 months and 6 months (Fig 3 and 4). During each visit, the clinical responses to the treatments were documented, and standard photographs were captured using the Visia facial photography system.

Using a 4-point rating system (0 = absence, 1 = mild, 2 = moderate, and 3 = severe), the treating physician

evaluated the scar's clinical reaction, including pain, erythema, oedema, hyperpigmentation, hypopigmentation, blistering, and eschar development.

The data were entered into MS Excel, and descriptive statistics were used to summarize the variables, which were then displayed with appropriate charts and graphs. The Shapiro-Wilk test was used to determine if the data were normal.

The Krippendorff's alpha and Chi-square tests were used to assess inter- and intra-rater reliability. For statistical significance, a threshold of 0.05 was established along with 95% confidence intervals. IBM SPSS v22 was the program used for all data analysis.

**Results**

This study treated 60 scars on the head, face, and neck, each of which was regarded as a separate sample. There were 35 men and 25 women in the research, ages 18 to 45, with a mean age of 25.1 years. Every patient had undergone surgery.

The mean post-operative pain rating scores for the areas treated with ultrapulse CO2 laser and manual dermabrasion were compared at different time points. At the end of the 1st month, the scores were 29.75 for CO2 laser and 31.25 for manual dermabrasion, which was not statistically significant. At the end of the 3rd month, the scores were 34.50 for CO2 laser and 26.50 for manual dermabrasion, with a p-value of 0.006, indicating statistical significance. At the end of the 6th month, the scores were 32.50 for CO2 laser and 28.50 for manual dermabrasion, with a p-value of 0.040, also showing statistical significance (Table 1).

CRITERIA	MONTH	GROUP 1	GROUP 2	P VALUE
PAIN	Month 1	29.75	31.25	0.704
	Month 3	34.50	26.50	0.006*
	Month 6	32.50	28.50	0.040*

Table 1: Pain during Follow up Visits in Group 1 and 2 Patients



The mean post-operative discomfort rating scores for the areas treated with ultrapulse CO<sub>2</sub> laser and manual dermabrasion were compared at different time points. At the end of the 1st month, the scores were 31.40 for CO<sub>2</sub> laser and 29.60 for manual dermabrasion. At the end of the 3rd month, the scores were 33.00 for CO<sub>2</sub> laser and 28.00 for manual dermabrasion, with no statistically significant difference. However, at the end of the 6th month, the scores were 32.50 for CO<sub>2</sub> laser and 28.50 for manual dermabrasion, with a p-value of 0.040, indicating statistical significance (Table 2).

CRITERIA	MONT H	GROU P 1	GROU P 2	P VALU E
DISCOMFO RT	Month 1	31.40	29.60	0.644
	Month 3	33.00	28.00	0.073
	Month 6	32.50	28.50	0.040*

**Table 2: Discomfort during Follow up Visits in Group 1 and 2 Patients**

The oedema of the side treated with ultrapulse CO<sub>2</sub> laser and manual dermabrasion had a mean post-operative rating score of 32.00 and 29.00 at the end of the first month, 33.00 and 28.00 at the end of the third month, which was not statistically significant, and 28.50 and 32.50 (p value 0.040) at the end of the sixth month, which indicates statistically significant (Table 3).

CRITERIA	MONT H	GROU P 1	GROU P 2	P VALU E
EDEMA	Month 1	32.00	29.00	0.405
	Month 3	33.00	28.00	0.095
	Month 6	28.50	32.50	0.038*

**Table 3: Edema during Follow up Visits in Group 1 and 2 Patients**

The hyperpigmentation of the side treated with ultrapulse CO<sub>2</sub> laser and manual dermabrasion had a mean post-operative rating score of 27.00 and 34.00 (0.012) at the end of the first month, which is statistically significant; 30.50 and 30.50 at the end of the third month; and 30.00 and 31.00 at the end of the sixth month, which is not statistically significant (Table 4).

CRITERIA	MONT H	GRO UP 1	GRO UP 2	P VALU E
HYPERPIGME NTATION	Month 1	27.00	34.00	0.011*
	Month 3	30.50	30.50	1.000
	Month 6	30.00	31.00	0.313

CRITERIA	MONT H	GROU P 1	GROU P 2	P VALU E
ESCHAR FORMATIO N	Month 1	30.50	30.50	1.000
	Month 3	30.50	30.50	1.000
	Month 6	30.50	30.50	1.000

**Table 4: Hyperpigmentation during Follow up Visits in Group 1 and 2 Patients**

At the end of the first, third, and sixth months, the mean post-operative rating score for escharment formation on the side treated with ultrapulse CO<sub>2</sub> laser and manual dermabrasion was 30.50 and 30.50, respectively. This difference was not statistically significant (Table 5).

CRITERIA	MONT H	GROU P 1	GROU P 2	P VALU E
ESCHAR FORMATIO N	Month 1	30.50	30.50	1.000
	Month 3	30.50	30.50	1.000
	Month 6	30.50	30.50	1.000

**Table 5: Eschar Formation during Follow up Visits in Group 1 and 2 Patients**

### Discussion

Scars are a common issue that typically develop following cutaneous dermal injury. Both manual dermabrasion and ultrapulse CO<sub>2</sub> laser skin resurfacing have been suggested as methods to improve the appearance of post-traumatic and post-surgical scars, but there is no conclusive agreement on which method is superior.

While scars may initially appear to be merely a cosmetic concern, they can significantly affect a patient's physical and mental well-being. Scars can physically restrict a patient's range of motion and cause pain, tingling, and itching, impacting their overall quality of life.[11]

Resurfacing using ultrapulse CO<sub>2</sub> laser and manual dermabrasion have both been suggested as ways to improve the look of scars from surgery and trauma. But there's no conclusive agreement on which approach is better. According to Jared et al. [4], the skin is subjected to a variety of torsional pressures throughout a full-thickness wound's main healing phase.

In the present study, we explore the effectiveness of ablative fractional 10,600 nm CO<sub>2</sub> laser for treating post-surgical scars in the head and neck region. We opted for early laser treatment within the first six months, prior to complete collagen organization, as this approach may



facilitate the management of older scars. Despite its potential, laser therapy continues to present challenges.

The standard dermaroller used for post-operative scar removal is a drum-shaped device featuring eight rows of 192 tiny microneedles, each 0.5 to 1.5 mm long and 0.1 mm in diameter. Reactive ion etching techniques are used to create these microneedles from silicon or medical-grade stainless steel. Gamma irradiation is used to presterilize the dermaroller, which is meant to be used just once.

Several studies have compared various methods of scar resurfacing, including manual dermabrasion, laser scar resurfacing, electroabrasion, and chemical peels.[12] According to a study by Domyati et al., chemical peeling has shown inferior results for scar resurfacing compared to other methods. However, other studies have not demonstrated significant differences among manual dermabrasion, laser scar resurfacing, and electroabrasion.

Since fractional CO<sub>2</sub> lasers (FCL) produce better results and fewer side effects than traditional ablative lasers, they are now widely used in scar management.[10] Pressure garments, intralesional corticosteroid therapy, dermabrasion, surgical corrections, chemical peels, laser treatment, and autologous platelet-rich plasma are among methods used to improve the look of scars.[13] Atrophic and hypertrophic burn scars, traumatic scars, and acne scars can all be successfully treated with lasers and nonablative devices, either in conjunction with or without PRP therapy as a substitute for surgery.

More than 50% of patients with posttraumatic scars showed moderate to excellent response, according to a study.[14] Faghihi et al. found that PRP improved scar repair more than fractional CO<sub>2</sub> laser (FCL) monotherapy. However, there was no statistically significant difference.[15] The study found that scars improved significantly after being treated with manual dermabrasion and ultrapulse CO<sub>2</sub> laser resurfacing.

The scars were treated with both Fractional Co<sub>2</sub> Laser and Manual Dermaroller and regular follow up were done at regular intervals. In this study, three scars exhibited hyperpigmentation at the 3rd month of follow-up. This hyperpigmentation was observed in scars treated with both manual dermabrasion and fractional CO<sub>2</sub> laser resurfacing, but it improved by the 6th month follow-up.

According to Tina Alster and Ranella Hirsch, individuals with darker skin (Fitzpatrick III - IV) are more prone to hyperpigmentation; however, it is generally transient and typically resolves within 4 to 6 weeks.[16]

In this research, fifteen scars revealed oedema immediately after the treatment, which improved after the first month. Oedema was found on the scar after both manual dermabrasion and fractional CO<sub>2</sub> laser resurfacing.

Nineteen patients reported discomfort during the perioperative phase for both manual dermabrasion and fractional CO<sub>2</sub> laser resurfacing. Sixteen patients reported pain during the perioperative phase for both manual dermabrasion and fractional CO<sub>2</sub> laser resurfacing. No patients in either group in this trial reported any adverse effects such as infection, hypopigmentation, or eschar formation. Our study had limitations due to the small sample size. We kept the laser parameters fixed for all scars to ensure consistency and minimize bias, but this approach may have led to some scars being undertreated or overtreated.

An ideal assessment would involve using ultrasonography to evaluate scar thickness, which could help determine the most appropriate laser type and parameters. Additionally, manual dermabrasion was challenging to perform on areas with lax skin. The mobility of the skin over underlying tissues hampered the procedure's accuracy and increased patient pain when nearby tissues stretched.

In these conditions, CO<sub>2</sub> laser resurfacing appears to be more effective than manual dermabrasion.

## Conclusion

CO<sub>2</sub> laser resurfacing and manual dermabrasion are both effective and safe scar resurfacing treatments for people with dark skin. Although hyperpigmentation is a possible consequence, it is often temporary. Ultrapulse CO<sub>2</sub> laser resurfacing was discovered to be more comfortable for the operator while causing less intraoperative discomfort for the patient. The treatment technique should be determined by the morphological type and severity of each scar.





We made an attempt to compare the efficacy of Scar resurfacing with Fractional CO<sub>2</sub> laser versus manual dermabrasion in the treatment of Post Surgical Scar, under the following parameters such as pain, discomfort, hyperpigmentation, eschar formation.

Thus, this study concludes that both techniques are equally effective in resurfacing the scars; however, the statistical analysis shows that the fractional CO<sub>2</sub> laser resurfacing technique is more effective than the derma roller in treating postsurgical scars.

**Data Availability** The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy regulations.

**Conflict of interest** The authors declare no conflict of interest. The authors have no relevant financial or non-financial interests to disclose.

**Institutional Review Board Statement** Ethical approval was waived by the local Ethics Committee of NIMS University, Rajasthan in view of the nature of the study and all the procedures being performed were part of the routine care.

**Informed Consent Statement** Patient consent was taken.

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