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The Effectiveness of Using CO_2 Fractional Laser and Mebo Burn Ointment Together in Treating Scars on the Face after Surgery

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Background: This study aimed to investigate the efficacy and safety of CO_2 fractional laser combined with Mebo burn ointment in treating facial postoperative scars.

Methods: Sixty patients with facial postoperative scars in the department of plastic surgery of Sun Yat-sen Memorial Hospital from January 2020 to June 2022 were divided into a control group (30 cases) and a study group (30 cases). Both groups received CO_2 fractional laser treatment, but the study group also received Mebo burn ointment application.

Results: The study found that both methods resulted in a significant decrease in Sawada score and a significant increase in Investigator Global Assessment score after treatment ($P < 0.05$), with the study group showing a more significant improvement and higher patient satisfaction ($P < 0.05$). All patients experienced varying degrees of bleeding, swelling, and erythema immediately after treatment, with two cases of pigmentation and two cases of persistent erythema in the control group, and one case of pigmentation and one case of persistent erythema in the study group. Adverse reactions were minimal, with the study group showing better tolerance.

Conclusions: The study suggests that CO_2 fractional laser combined with Mebo burn ointment is an effective and safe treatment for facial postoperative scars.
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Hypertrophic scars are a significant challenge in the treatment of trauma and surgery. They are characterized by excessive proliferation of fibroblasts and excessive accumulation of extracellular matrix as a basic pathological change, leading to the appearance of skin scars. As they are one of the most common complications in the healing of skin injuries,[1] patients may experience clinical manifestations such as pain, itching, and functional abnormalities, especially in facial scars, which can have a certain impact on the patient's appearance and quality of life. There is no unified treatment method for hypertrophic scar treatment at home and abroad.[2] Local injection of triamcinolone acetonide is the preferred method for scar treatment in clinical practice. In recent years, the continuous progress of medical technology and equipment has provided diversified choices for the treatment of this disease. In previous treatments, the main treatment methods for this disease included chemical peeling, dermabrasion, etc. Although the above methods have certain therapeutic effects, the recurrence rate is still high. In recent years, due to the continuous development and application of laser medicine in practice, micro-needle and other treatment methods have been recognized and have achieved certain clinical treatment effects. However, many clinical practices have shown that the effect of using a single method for treatment, such as pigmentation, is not obvious. This study aimed to investigate the therapeutic effect of combining Mebo burn ointment and CO_2 fractional laser in the treatment of facial postoperative scars. The results are reported as follows.

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DATA AND METHODS

General Information

The study included 60 patients with facial scars after surgery who were treated at our hospital from January 2021 to January 2023. There were 15 men and 45 women, aged 4–54 years with a mean age of (23.9±10.4) years. The scar

Disclosure statements are at the end of this article, following the correspondence information.

area ranged from 0.5 to 5.0 cm^2. Inclusion criteria include (1) scars located on the face after surgery; (2) no complications such as infection or wound dehiscence; (3) no previous treatment for scars of other types; (4) all patients signed informed consent forms. Exclusion criteria include (1) pregnant or lactating women; (2) patients who received systemic antibiotics, contraceptives, or photosensitive drugs within one month before treatment, or those with a history of photosensitivity or keloids; (3) patients who underwent chemical peels, laser, or intense pulsed light treatment within the previous 3 months, or those who received botulinum toxin or facial fillers within the previous 6 months; (4) patients with related systemic diseases such as heart, liver, kidney, cancer, or mental and psychological disorders; (5) patients with other facial skin diseases such as seborrheic dermatitis that may interfere with treatment efficacy; (6) patients with high expectations for treatment efficacy; (7) patients with incomplete data or who did not cooperate with follow-up. This study was approved by the hospital ethics committee (approval no.: SYSKY-2023-368-01).

Methods

Grouping

This study was divided into two groups: a control group treated with CO_2 fractional laser, and an observation group treated with a combination of CO_2 fractional laser and Mebo burn ointment.

Pretreatment Preparation

Fractionated laser treatment began 1 month after suture removal; three treatment sessions were performed at two month intervals. Before each treatment, the scarred area on the patient's face was photographed using a digital SLR camera (Canon EOS 500D) and stored. The scar area was then evenly coated with a compound lidocaine cream and covered with a fresh film for surface anesthesia for 40–60 minutes. After the above operation was completed, the face was cleaned and disinfected in the usual way before CO_2 fractional laser treatment.

Treatment Method

CO_2 fractional laser treatment was performed using the Acupulse CO_2 fractional laser system (Lumenis, Santa Clara, Calif.) with a wavelength parameter set to 10,600 nm and the deep mode. The entire scar was treated with this mode (energy parameter adjusted to 30 mJ/cm^2; density adjusted to 5%; spot size adjusted according to the size of the scar). The treatment endpoint was when the wound appeared pink, with a small amount of oozing and mild inflammatory edema.

1. Control group: After laser treatment, apply ice for 20–30 minutes.
2. Observation group: Apply ice after treatment and then apply Mebo moisturizing burn ointment to the facial wound for 7 days, five times a day.

Posttreatment Care

Within 7 days after treatment, the wound should be kept dry and not washed with facial cleansers. The scab should not be forcibly removed and should be allowed to fall off naturally. Sun protection should be applied during treatment.

Takeaways

Question: This article mainly solves how to promote the wet healing of wounds after carbon dioxide dot matrix laser treatment.

Findings: The effect of MEBO on wound healing after treatment was found.

Meaning: The significance is to refine the nursing procedure after dot matrix laser treatment and promote wound healing to the maximum extent.

Observation Indicators

Sawada Score

Two doctors evaluated the before and after treatment photographs using the Sawada score.[3] The scar was evaluated based on its color, height, hardness, itching, and tenderness or pain, and the scores were added together. The lower the score, the more similar the scar was to normal skin. The scoring criteria are shown in Table 1.

Doctor's Visual Assessment (IVA) Score

Two doctors are required to perform IVA scoring on pre- and posttreatment photographs. The four-point scoring method[4] can be used: one point represents no significant improvement or mild improvement (<25%); two points represent moderate improvement (ranging from 25% to 50%); three points represent significant improvement (ranging from 51% to 75%); and four points represent complete improvement (>75%).

Table 1. Sawada Score

Sawada Score	
Redness	+++: severe redness, associated with telangiectasia
	++: redness, disappears with pressure
	+: no redness, but black appearance
	-: normal skin color
Elevation	+++: over 8 mm in height above surrounding skin
	++: 4–8 mm
	+: 1–4 mm
	-: flat or depressed scar
Hardness	+++: very hard, like cartilage
	++: rubbery hard
	+: partially soft
	-: soft (like normal skin)
Itching	+++: severe itchy sensation or constantly itchy, with signs of scratching
	++: occasionally itchy sensation, moderate and tolerable
	+: sometimes itchy
	-: no itchy sensation
Tenderness or pain	+++: severe irritable pain
	++: moderately irritable pain
	+: sometimes painful
	-: without pain

Pain Score

Patients are evaluated for their pain perception after each treatment through follow-up, and the pain score is assessed using the 0–10 visual analog scale.[5] A score of 0 represents no pain, with no sensation of pain; 1–3 points represent mild pain, with only slight pain sensation; 4–6 points represent moderate pain, which can still be tolerated; and 7–10 points represent severe pain, with intense pain that cannot be tolerated.

Satisfaction Evaluation

Starting from the second treatment, patients are evaluated for their satisfaction with the treatment, which is divided into four levels: level 1 represents dissatisfaction; level 2 represents average satisfaction; level 3 represents satisfaction; and level 4 represents high satisfaction.

Safety Evaluation

The adverse reactions that occur during the treatment are recorded in detail through follow-up, which is completed by both the patient and the follow-up personnel. The adverse reactions that need to be recorded mainly include erythema, edema, ecchymosis, pigmentation, and exudation, and the duration and subsidence time should also be recorded. The suspension period should be carefully recorded, from the end of the patient's treatment until the scab falls off and the skin returns to normal without affecting daily life.

Statistical Analysis

In this study, SPSS 25.0 software was used for statistical analysis of the data. The D'Agostino test was used to test the normality of the metric data. Indicators that followed a normal distribution were expressed as mean ± SD (±s), and the independent sample *t* test was used for intergroup comparison. Indicators that did not follow a normal distribution were expressed as median and interquartile range, and the Mann-Whitney *U* test was used for intergroup comparison. The nonparametric rank sum test was used for ordinal data, and a *P* value less than 0.05 was considered statistically significant.

RESULTS

Comparison of General Data between the Two Groups of Patients

As shown in Table 2, the observation group (n = 30) consisted of nine men and 21 women, with an average age of (23.8 ± 11.4) years; the control group (n = 30) consisted of six men and 24 women, with an average age of (24 ± 9.5) years. There was no significant difference in the general data (gender and age) between the two groups, indicating comparability ($P > 0.05$).

Table 2. Comparison of General Data Between the Two Groups of Patients

Group	n	Man/Woman	Average Age (y)
Observation group	30	9/21	23.8 ± 11.4
Control group	30	6/24	24 ± 9.5

Comparison of Clinical Photographs before and after Treatment in the Two Groups of Patients

Compared with before treatment, the area of scars, depressions, and skin color in both groups improved significantly after treatment. In the control group, the scar on the left side of the face after surgery was about 10.0 cm × 0.2 cm, with pigmentation and slightly improved blood supply. There was obvious atrophy in the middle of the scar, which was about 1 mm lower than the normal skin (as shown in Fig. 1A); after one treatment, there were significant improvements in scar area, blood supply, depression, and pigmentation compared with before treatment, and the atrophy was moderately improved (as shown in Fig. 1B); after two treatments, these indicators showed significant improvement compared with before treatment (Fig. 1C); after three treatments, there was still a slight depression, mild atrophy, and pigmentation at the original scar site (as shown in Fig. 1D). In the observation group, the scar on the forehead after surgery was about 2.2 cm × 0.1 cm, which was about 0.1 mm smaller than the normal skin, with slight depression and pigmentation loss (Fig. 2A); after one treatment, there was a slight improvement in scar area and pigmentation loss compared with before treatment (Fig. 2B); after two treatments, the above improvements were better than before (Fig. 2C); after three treatments, there was only a slight scar at the original scar site (Fig. 2D).

Comparison of Sawada Scores between the Two Groups of Patients

As shown in Table 3, using analysis of variance, the effect of different treatment regimens on Sawada scores over time was evaluated. There was no significant difference in this indicator between the two groups before treatment ($P > 0.05$). After one, two, and three treatments, the Sawada scores in the observation group were significantly lower than those in the control group, with significant differences ($P < 0.05$).

Comparison of IVA Scores between the Two Groups of Patients

As shown in Table 4, the effect of different treatment methods on IVA scores over time was evaluated. After the first and second treatment, there was no statistically significant difference in IVA between the two groups. But after three treatments, the IVA scores in the observation group were significantly higher than those in the control group, with significant differences ($P < 0.05$).

Satisfaction Evaluation

As shown in Table 5, after the first and second treatment, there was no statistically significant difference in satisfaction between the two groups. However, after the third treatment, there was a statistically significant difference in satisfaction ($P < 0.05$).

Pain Score and Downtime

As shown in Table 6, there were significant differences in pain scores between the two groups of patients ($P < 0.05$) and no statistically significant difference in the

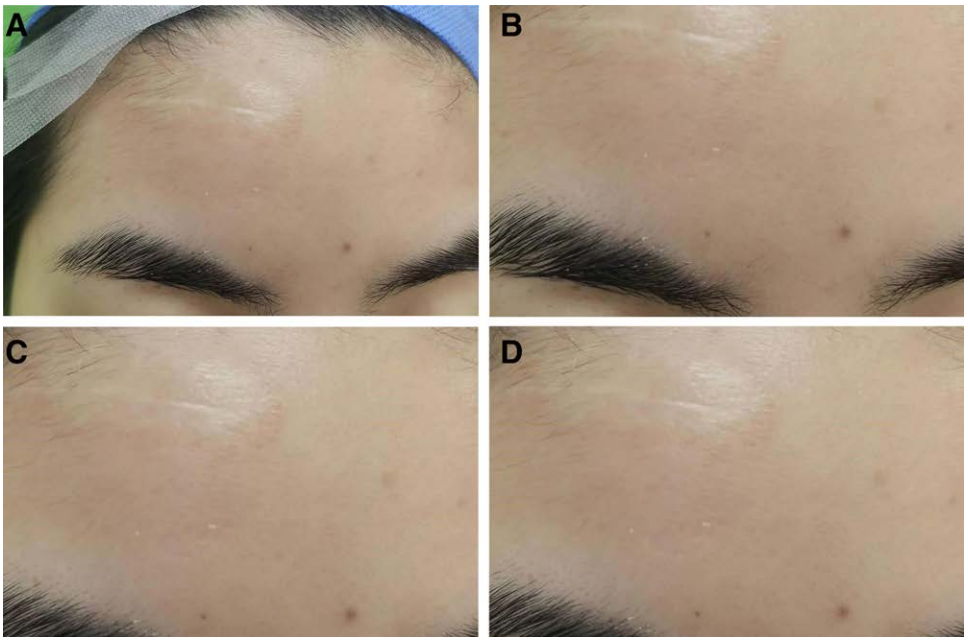

Fig. 1. A comparison of a facial scar patient (control group) before and after treatment with a simple CO_2 fractional laser. A, Before treatment, mild concave scars and pigment loss could be observed on the forehead, which were about 0.1 mm lower than normal skin. B, After one treatment, the scar area and pigment loss showed improvement compared with before. C, After two treatments, the improvement was more significant. D, After three treatments, there were still mild concave scars and pigment loss.

downtime. The pain was more significant in the control group.

Adverse Reactions

After treatment, both groups of patients had varying degrees of pain, erythema, ecchymosis, edema, exudation, and oozing in the local area, which did not require special treatment. The treatment area usually scabbed over in 6–8 hours, and the scab peeled off in 3–5 days in the control group and 5–7 days in the observation group. In the control group, two patients (6.7%) had persistent erythema after surgery, and two patients (6.7%) had pigmentation loss; in the observation group, one patient (3.3%) had persistent erythema after surgery, and one patient (3.3%) had pigmentation loss. The erythema disappeared completely within 1–2 weeks after treatment, and the pigmentation loss appeared in 3–4 weeks and may disappear. None of the patients had blisters, infections, or hypertrophic scars after treatment.

DISCUSSION

CO_2 fractional laser has become a first-line treatment for preventing scars recommended by clinical guidelines[6] and is also used as a basic treatment for postoperative scars in our department. The laser can reach the corresponding depth of tissue, which is conducive to the role of skin in situ regeneration therapy in preventing scar hyperplasia.[7–16] However, the method of simple CO_2 fractional laser only serves the wound healing process and cannot change scar tissue into physiological skin tissue. How to construct a wound healing environment after CO_2 fractional laser treatment has become a research focus. In the early 20 years of burn clinical practice, the Department of Plastic Surgery of Hunan Provincial People's Hospital selected Mebo moist burn ointment from dozens of wound medications, and clinical practice has shown that this drug is most in line with the requirements of moist regeneration treatment.[17] The ingredients of Mebo moist burn ointment, as stated in the drug instructions, are *Coptis chinensis, Phellodendron amurense,* pheretima, poppy shell, sesame oil, and beeswax. The pharmacological structure of Mebo moist burn ointment makes it a good alternative for wound healing. Firstly, it uses oily substances as a medium to provide a moist environment suitable for wound growth. Secondly, it uses a beeswax structure as a scaffold and adopts a mesh structure to cover the wound, avoiding the harm caused by exposure to harmful substances (such as microorganisms, oxygen and contaminants), while keeping the wound tissue in communication with the outside world; in addition, the drug, which is designed according to bionic principles, provides necessary nutritional support for stem cells. Therefore, we chose Mebo burn ointment as the experimental observation of laser wound medication to confirm that the moist wound healing environment created by Mebo moist burn ointment is conducive to the regeneration and repair of scar laser wounds.

Our clinical application research shows that the combination of CO_2 fractional laser and Mebo burn ointment can reach the corresponding depth of tissue, which is conducive to the good role of fractional laser and skin in situ regeneration therapy in preventing scar hyperplasia. The combination of the two can achieve the maximum

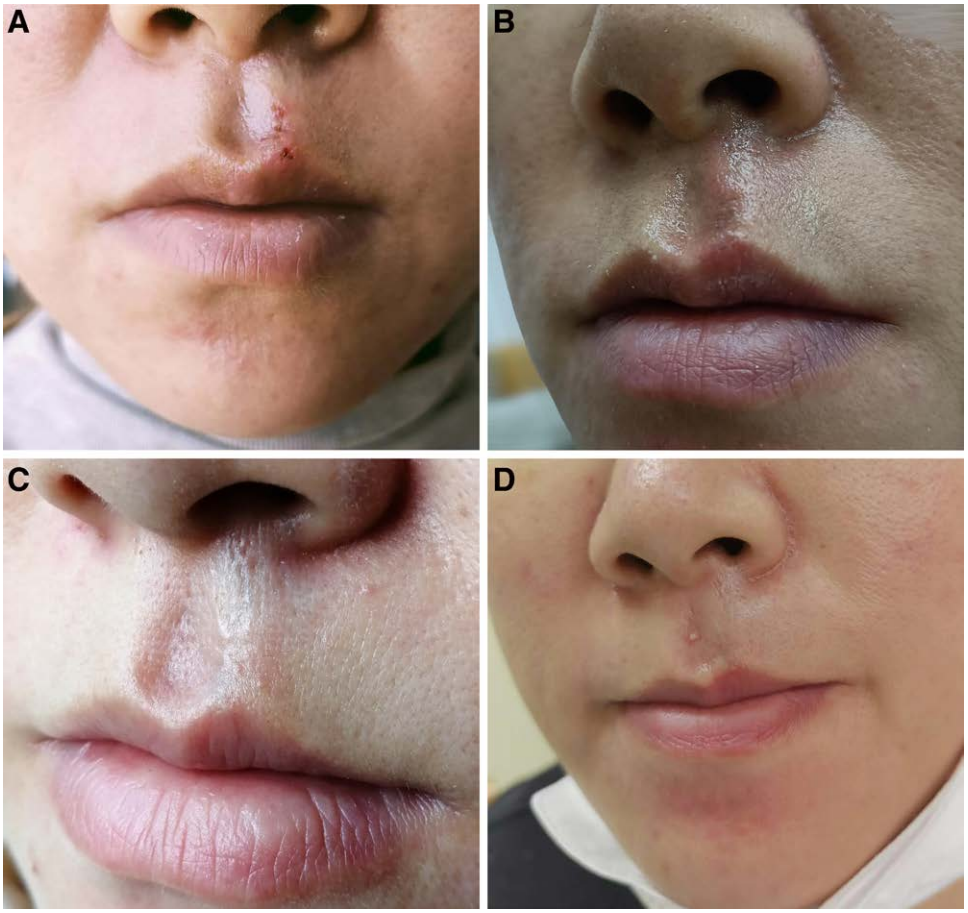

Fig. 2. A comparison of a facial scar patient (observation group) before and after CO_2 fractional laser combined with Mebo burn ointment treatment. A, Before treatment, there were sunken scars with suture marks around the philtrum, pigmentation, mild increase in blood supply, and central atrophy of the scar, which was about 0.1 mm lower than normal skin. B, After one treatment, the scar area, pigmentation, blood supply, and degree of depression all improved to varying degrees compared with before, and the suture marks decreased. The atrophy was slightly improved compared with before. C, After two treatments, the improvement was more significant. D, After three treatments, only mild scars remained in the philtrum.

Table 3. Comparison of Sawada Scores between the Two Groups of Patients

Group	n	Before Treatment	1 Month after the First Treatment	1 Month after the Second Treatment	1 Month after the Third Treatment	3 Months after the Third Treatment	6 Months after the Third Treatment
Control group median (Q1, Q3)	30	2.00(1.00, 4.00)	3.00(2.00, 4.00)	4.00(2.75, 5.00)	5.00(3.00, 5.00)	4.50(2.00, 6.00)	4.00(2.00, 5.25)
Experimental group median (Q1, Q3)	30	2.00(1.00, 4.00)	2.00(1.00, 3.00)	3.00(2.00, 4.00)	3.00(2.00, 4.00)	3.00(1.75, 3.00)	2.00(1.00, 3.25)
Statistic		0.000	–	–	–	–	–
P		1.000	0.007	0.010	<0.001	0.002	0.004

degree of in situ regeneration of hypertrophic scar tissue to restore it to near-normal skin tissue, and the therapeutic effect is significantly better than traditional methods. Research data have confirmed that the healing degree of the treatment group is the histological program of skin in situ regeneration and can make scar tissue regenerate into physiological skin tissue. Animal preexperiments have preliminarily verified the feasibility of this technology.[18] In the study of the scar healing process using this technology, it was found that when studying the wet burn ointment group, several substances continuously increased on the fourth day after the injury, mainly including the epidermal stem markers K19 and P63 protein. They will reach a peak on the seventh day, and the quantity will decrease after the 14th day. It is currently known that the P substance participates in the migration, differentiation, and

Table 4. Comparison of IVA Scores between the Two Groups of Patients

Group	n	1 Month after the First Treatment	1 Month after the Second Treatment	1 Month after the Third Treatment	3 Months after the Third Treatment	6 Months after the Third Treatment
Control group median (Q1, Q3)	30	1.00(1.00, 1.00)	1.00(1.00, 1.00)	1.00(1.00, 2.00)	2.00(1.00, 2.00)	1.00(1.00, 2.00)
Experimental group median (Q1, Q3)	30	1.00(1.00, 1.00)	1.00(1.00, 2.00)	1.00(1.00, 2.00)	2.00(1.00, 3.00)	2.00(1.00, 3.00)
Statistic		0.088	−1.416	0.025	−0.815	−3.309
P		0.930	0.157	0.980	0.415	<0.001

Table 5. Comparison of Satisfaction Evaluation of Patients with Different Treatment Frequencies in Two Groups

	Observation Group				Control Group					
No. Treatments	Dissatisfaction	Average Satisfaction	Satisfaction	High Satisfaction	Dissatisfaction	Average Satisfaction	Satisfaction	High Satisfaction	*Z*	*P*
After 1st treatment	2 (6.7)	10 (33.3)	10 (33.3)	8 (26.7)	6 (20.0)	11 (36.7)	7 (23.3)	6 (20.0)	-1.418	0.156
After 2nd treatments	1 (3.3)	6 (20.0)	12 (40.0)	11 (36.7)	4 (13.3)	10 (33.3)	9 (30.0)	7 (23.3)	-1.851	0.064
After 3rd treatments	0 (0.0)	7 (23.3)	14 (46.7)	9 (30.0)	4 (13.3)	16 (53.3)	7 (23.3)	3 (10.0)	-3.435	0.001

Table 6. Pain Score and Downtime

	Observation Group	Control Group	Statistic	*P*
Pain score median (Q1, Q3)	3.00(2.00, 4.00)	4.00(3.00, 6.00)	3.063	0.002
Shutdown period median (Q1, Q3)	3.00(3.00, 4.00)	3.00(2.00, 4.00)	0.084	0.933

regulation of epidermal stem cells.[19–22] Therefore, it is speculated that this technology can stimulate the production of P substance, activate potential regenerative cells, and transform them into epidermal stem cells under the physiological regeneration environment provided by the wet burn ointment and the action of skin regeneration biomaterials.

The author used a combination of two methods to treat postoperative scars on the face and achieved satisfactory results. The relevant mechanism is as follows: (1) Mebo moist burn ointment can improve microcirculation to a certain extent, which is conducive to the recovery of the lattice laser wound stagnation zone, automatic drainage function, prevention of wound infection, and promotion of wound healing. (2) It can create favorable conditions for wound healing. (3) Mebo moist burn ointment can provide skin organ regeneration materials and have a certain physiological regulatory effect on skin growth. During the treatment period, whether it is epithelial cells or fibroblasts, they will grow according to a certain proportion requirement, and the arrangement of collagen bundles is very regular. Compared with normal, there is no significant difference in the growth ratio between epithelial cells and collagen fibers. (4) After healing, the use of this type of ointment in combination can effectively limit abnormal proliferation such as fibroblasts, and the ointment can effectively regulate the number and morphological changes of epithelial cells and collagen fibers. The moist environment can effectively reduce the irritation caused by dryness, and the patient feels very comfortable, effectively reducing the patient's pain and negative psychological impact. Traditional surgical laser treatment often keeps the wound dry and uses erythromycin ointment. The patient's wound pain and negative psychological impact are obvious. In the healing stage, due to the lack of physiological regulation and negative psychological impact, the newly formed capillaries and collagen bundles are more chaotic and twisted, and the scars caused by general treatment are more and heavier, increasing the patient's pain.[23–28]

Based on the above mechanism, the authors conducted a randomized controlled study of 60 cases, combining in situ skin regeneration therapy with fractional CO_2 laser treatment for facial postoperative scars. The effect of skin in situ regeneration therapy in the treatment of facial postoperative scars with fractional CO_2 laser was significantly better than that of traditional methods. The use of fractional CO_2 laser alone also had a certain effect, but the effect was more significant when combined with skin in situ regeneration therapy. It can significantly reduce pain, increase wound healing rate, and improve the therapeutic effect of the symptom, making it a more ideal choice for preventing and treating postoperative scar hyperplasia. And as the number of treatments increases and the duration prolongs, the effect becomes more pronounced. With the continuous deepening of research on this disease, the combination of in situ skin regeneration therapy and fractional CO_2 laser treatment is expected to become a new concept and effective method for the prevention and treatment of pathological scars. Although this work is still in the stage of continuous research, prevention and treatment should be combined, and early intervention in wound healing should be carried out. With the continuous research on this disease, new and effective methods will continue to emerge.

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DISCLOSURES

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