Spot CO₂ Laser Revision of Facial Atrophic Linear Scars in Korea

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Background and Objectives

As interest in aesthetic has shown a recent increase, the number of patients who want their facial scars to be treated is increasing. This current report demonstrates scar revision using a conventional spot CO₂ laser regardless of aesthetic units to smooth the scar tissue and stimulate to form the synthesis of collagen for facial atrophic scars.

Materials and Methods

We conducted a retrospective study on 32 posttraumatic or postoperative scars of 32 patients. Patients were treated by conventional spot CO₂ laser therapy. All patients were followed for six months after treatment.

Results

The conventional spot CO₂ laser abrasion is effective for treatment of posttraumatic and postoperative scars and has positive effects, particularly on scar texture and thickness without significant adverse effects. Prior to the laser session, these scars showed different pigmentation, pliability, height, and vascularity compared to the surrounding skin. The conventional spot CO₂ laser significantly improves thickness and textural issues. Patients also expressed a 4-point subjective scale of satisfaction. Patients were also significantly more satisfied with the treated scars.

Conclusion

This study shows that conventional spot CO₂ laser abrasion of facial atrophic linear scars is an effective treatment modality for facial scars. In addition, this laser does not show any serious adverse effects.

Key words

CO₂ laser; Scar management; Laser abrasion

INTRODUCTION

As the interests of aesthetic picks up recently, the number of patients who want their facial scars to be treated is increasing. And the variety of scar treatment also is diversifying. There are non-surgical methods and surgical methods for treatment of facial scar. Silicone gel, silicone sheet, and Retinoid A derivatives are the examples of non-surgical methods. But the efficacy is limited and is only used to treat mild scars. In surgical methods, there are chemical peeling, dermabrasion, laserabrasion and etc.¹ Every method has advantages, disadvantages and specific indications. So we have to choose the suitable treatment for the character and the type of a scar. One may use nonablative or ablative fractional

laser resurfacing, however neither of them can reach the efficacy of conventional spot CO₂ laser abrasion. The spot CO₂ laser abrasion we used in our research means the conventional ablative laser resurfacing. It is still the gold standard for laser resurfacing, although it can be associated with undesirable adverse effects, including a high risk of erythema, infection and discoloration, as well as a prolonged recovery period, as compared to fractional laser treatments.²⁻⁶ The laser abrasion conventional spot CO₂ laser can vaporize the scar tissue with minimally thermal injury around the adjacent tissue. Clinically it is safe to remove the scar tissue tended to treat. So it can be used to various skin lesions. Beside wrinkles, it can be used to the chickenpox, acne scars. The conventional spot CO₂ laser abrasion is used to

Table 1. Patient characteristics and scar assessment after 6 months of conventional spot CO₂ laser treatment

No.	Sex/age	Scar location	Vancouver scar scale score			Patient satisfaction scale
			Initial	After treatment		
				6 months	Improvement grade	
1	M/51	Chin	7.3	1.5	5.8	Good
2	F/19	Nose	5.6	1.0	4.6	Poor
3	F/32	Philtrum	6.3	1.3	5	Good
4	F/4	Eyebrow, Lt.	7.2	1.7	5.5	Good
5	M/62	Malar area, Rt.	5.9	2.6	3.3	Excellent
6	F/42	Nose	5.6	2.9	2.7	Excellent
7	M/32	Chin	5.0	3.2	1.8	Good
8	M/54	Philtrum	7.4	2.1	5.3	Excellent
9	F/19	Forehead	9.2	0.9	8.3	Excellent
10	F/26	Nose	8.4	0.5	7.9	Good
11	M/32	Cheek, Rt.	7.4	1.3	6.1	Excellent
12	F/22	Nose	8.6	1.5	7.1	Good
13	M/38	Forehead	7.2	2.9	4.3	Fair
14	M/10	Chin	6.8	3.2	3.6	Excellent
15	F/13	Malar area, Rt.	7.1	2.1	5	Excellent
16	F/45	Forehead	9.0	0.9	8.1	Good
17	F/33	Lower eyelid, Lt.	6.5	0.5	6	Good
18	M/16	Philtrum	5.8	1.5	4.3	Good
19	F/54	Nose	5.7	1.0	4.7	Good
20	F/58	Malar area, Lt.	6.2	0.5	5.7	Good
21	M/44	Temple area, Rt.	6.9	1.0	5.9	Good
22	F/32	Forehead	5.4	1.7	3.7	Excellent
23	F/20	Temple area, Lt.	8.8	1.6	7.2	Fair
24	M/27	Cheek, Rt.	8.5	1.7	6.8	Excellent
25	M/19	Nose	7.6	3.2	4.4	Good
26	F/52	Temple area, Lt.	7.3	0.9	6.4	Good
27	F/34	Upper eyelid, Rt.	8.4	1.3	7.1	Good
28	F/41	Nose	6.2	1.2	5	Poor
29	F/40	Nose	6.3	1.0	5.3	Good
30	M/25	Chin	4.5	0.8	3.7	Fair
31	F/36	Upper eyelid, Rt.	5.1	2.6	2.5	Excellent
32	M/20	Chin	5.6	2.9	2.7	Fair
Mean			6.84 (SD 1.27)	1.66 (SD 0.86)	5.18 (SD 1.69)	

treat scars before the fractional laser emerging. But we suggested that the conventional spot CO₂ laser cause better results than the fractional laser in long-term follow-up periods. And in most cases, the conventional spot CO₂ laser treatment is ended at once, which is more convenient for patient than the fractional laser. So we presents out research about results of treatment by conventional spot CO₂ laser. We revise the scar lesions scar revision using conventional spot CO₂ laser regardless of aesthetic units to smooth the scar tissue and stimulate to form the synthesis of collagen for facial atrophic scars.

MATERIALS AND METHODS

We performed a retrospective study on the postoperative scars of 32 patients (13 men 19 women) of ages from 4 to 62 (average age, 33 years) recruited through the department of plastic surgery, Soonchunhyang hospital by evaluating outpatients for studying October 2001 to February 2005 (Table 1). The anatomic distribution of scars was entirely on the face. Exclusion criteria were a history of keloid scarring, isotretinoin use, infection of the postoperative scar, and oral anticoagulant use. We reviewed the patient's charts and photographs under the consents.

Patients were followed for 6 months after the treatment. We used an Ultrapulse Encore CO₂ Laser to apply on the scars. We cleansed the area to treat using chlorohexidine, and a topical anesthetic (eutectic mixture of 2.5% lidocaine hydrochloric acid and 2.5% prilocaine; EMLA cream, AstraZeneca AB, Södertälje, Sweden) for 1 hour before laser treatment. The treatment settings were a fluency of 100 mj-150 mj and a power of 40-50 W in the CPG mode. The scar was passed 2-5 times by laser. If there is step appearance between the scar and the adjacent tissue, the shoulder technique is used. After every pass, the dead tissue is cleansed by gauze wetted by normal saline. Then the moisture was removed by dry gauze. Around periorbital area, the patient took an eye protector. After treatment, the treated areas were cooled with ice packs for 5 to 10 minutes to remove heatness and relieve pain. A hydrocolloid dressing (DuoDERM CGF Extra Thin, ConvaTec, ER Squibb & Sons, Princeton, NJ) was applied to the treated area at every 2 days. To get complete epithelization, a moisturizer and antibiotics oint were applied for 1 or 2 weeks and then a sunblock and 4% hydroquinon cream were applied at least 3-4 months. A color make up is prohibited for 4 weeks. We can apply conventional spot CO₂ laser regardless of an aesthetic unit and a relaxed skin tension line.

Photographs were taken at baseline, 6 months after the laser treatment. The experienced 2 independent physicians made objective assessments using the Vancouver Scar Scale (VSS), which includes pigmentation (0 = normal, 1 = hypopigmented, 2 = mixed pigmentation, 3 = hyperpigmented), pliability (0 = normal, 1 = supple, 2 = yielding, 3 = firm, 4 = ropes, 5 = contracture), height (0 = flat, 1-2 mm, 2 = 2-5 mm, 3-5 mm), and vascularity (0 = normal, 1 = pink, 2 = red, 3 = purple). Three and Six months after the last treatment, patients were asked to rate their overall satisfaction using a grading scale (excellent, good, fair, poor). Patients were also questioned about side effects of the treatment.

We compared patient satisfaction degrees using VSS, and adverse events using a Wilcoxon signed-rank test with SPSS version 17.0 (SPSS Inc., Chicago, IL, USA). Differences were considered statistically significant when $p < .05$.

RESULTS

Mean VSS scores for the treated scars were 6.84 (SD 1.27) before treatment, 1.66 (SD 0.86) six months after treatment (Table 1).

The patient's overall satisfaction using a grading scale was also significantly high with the their treated scar. 10 of the 32 patients (31.2%) were excellent, 16 (50%) were good, 4 (12.5%) was fair, and 2 (6.3%) were poor with the results. The atrophic linear scar was significantly improved by conventional spot CO₂ laser treatment during the followed period (Fig. 2).

Most of adverse effects, such as post-treatment edema and scaling, resolved within 1 week. It doesn't show any serious adverse effect such as post-treatment blisters,

Fig. 1. Improvement of VSS parameters at final assessment compared to initial assessment.

Fig. 2. 4 year-old female (A) prior to first laser treatment (B) 2 days after the laser treatment (C) 3 month after laser treatment. (D) 6 months after the CO₂ laser treatments, showing nearly complete resolution and blending of the scar line with the surrounding skin.

scarring, and wound infection.

The average of time to reepithelization of epithelial cell was 7-14 days. After conventional spot CO₂ laser treatment, erythema remains for 2 weeks up to 2 months and PIH (Post-inflammatory hyperpigmentation) remains up to 3-4 months. Two of the patients presented PIH during 5 months after treatment. The laser treatment we used is relatively easy to use and apply any facial scar regardless of an aesthetic unit or relaxed skin tension line. The satisfaction level is high but it must be cautioned that post-treatment care is needed because of the risk of erythema and hyperpigmentation.

DISCUSSION

It is suggested that the conventional spot CO₂ laser is effective for treating surgical linear scars in the facial area in the postoperative period, especially on scar texture and thickness. There have been many studies performed using various kinds of lasers in the postoperative or posttraumatic scars.

One of the main concerns with abrasion lasers in scar treatment has resulted in erythema & PIH. Korean skin type mostly belongs to Fitzpatrick classification skin type III-IV, so PIH is likely to occur. But in our research, most of patients received post-treatment care well and the adverse effects such as erythema and PIH resolved within 3-4 months. Only two patients experienced PIH after the treatment up to 5 months. If there were patients who wanted to take a secondary revision, it could be done after 1 year later. A previous study with CO₂ laser suggested that densities of 30% to 50% coverage can be safely used for scars on the face and 20% to 30% for those off the face and that more-favorable results are obtained using lower fluency for off-face sites.⁷ It implies that scar location affects the laser settings for most efficacy. Further research is needed for the specific parameter in the settings comparing treatment settings.

In our research, we evaluated the state of pigmentation, vascularity, pliability, and thickness. The conventional spot CO₂ laser made an improvement in pliability and thickness than in vascularity and pigmentation.

Physicians are reluctant to use abrasion lasers because of the significant risks of prolongation of post-treatment erythema and possible permanent pigmentary changes.

The limitations of this study include the lack of comparison with the control group. A split-scar study could help understand the effects of conventional spot CO₂ laser treatment. Second, the number of patients is relatively small. In large population in study, it would help to evaluate the result more accurately. Third, this study doesn't include comparison with scar treatment using fractional CO₂ laser. Recently, the fractional CO₂ laser is used in scar management and getting popularity. It could help if there was comparison of the effect and adverse effect between spot and fractional CO₂ laser. Last, the term of study is relatively short. Longer-term follow-up is needed to evaluate the course of treated scars.

Treatment using spot CO₂ laser may provide scars to improve rapidly and may prevent scar formation. The laser abrasion may help scars to flatten the irregular surface of atrophic scars and planish the margin between scars and adjacent tissue to make properties of scar margin look similar. The shrinkage of a scar tissue makes scar size smaller. The arrange of collagen of regenerated tissue is regular, which provides the improvement effect of scar texture and scar pliability without any serious adverse effects.

CONCLUSION

This study shows that spot CO₂ laser treatment of facial linear scars is an effective treatment modality for facial

scars. This laser also does not show any serious adverse effect. But we have to take care of occurring erythema and PIH after the treatment. In our research, even Fitzpatrick classification skin type III~IV, common in Korean, also shows satisfying results and the cautious posttreatment care make results not to remain severe adverse effects.

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