

Carbon Dioxide Laser Abrasion

Is It Appropriate for All Regions of the Face?

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Objectives: To evaluate the effectiveness of the carbon dioxide laser for treatment of facial acne scarring and to determine if certain regions of the face would respond more favorably to carbon dioxide laser resurfacing than other areas of the face.

Methods: Twenty-five patients with facial acne scarring were treated with the carbon dioxide laser with the flash-scanning attachment. Physician and patient evaluations were performed at postoperative follow-up. The face was evaluated for improvement by 5 anatomic regions: medial and lateral cheeks, perioral region, temple, and forehead.

Setting: Office ambulatory surgery center.

Results: Patients demonstrated overall improvement with

the carbon dioxide laser. However, certain areas, such as the lateral cheek and temple, responded less favorably than other areas, such as the medial cheek, perioral region, and forehead. These findings were found to be statistically significant ($P < .001$) for physician and patient assessments. No long-term complications were reported.

Conclusions: The carbon dioxide laser is an effective modality for the treatment of facial acne scarring. Physician and patient satisfaction is high. Nevertheless, multiple treatments may be necessary to achieve improvement, especially in the temple and lateral cheek areas; these anatomic sites respond less favorably to laser resurfacing than the medial cheek, perioral region, and forehead.

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CARBON DIOXIDE laser resurfacing has established itself as a safe and relatively easy procedure in the treatment of facial rhytides and acne scarring. In many practices, it has replaced other resurfacing procedures such as chemical peeling, dermabrasion, and electrosurgical planing. While these techniques have been beneficial, they have limitations, including pigmentary changes and variable depth of effect, and may be more technically difficult to perform.

Two forms of laser technology have evolved that allow carbon dioxide laser vaporization of tissue with minimal peripheral thermal coagulation: the high-energy, short-pulsed system and the scanned system. The high-energy, short-pulsed carbon dioxide laser system uses a flash of energy that is short in duration such that the heat does not dissipate into the surrounding tissue. The scanned carbon dioxide laser system uses a computer-controlled mirror to rapidly scan an area in less time than is needed to dissipate heat into the surrounding tissue. The

critical threshold of time that heat requires for dissipation is known as the *thermal relaxation time* and for skin is approximately 1 millisecond. These 2 laser systems produce a pulse duration time or tissue dwell time that is less than this critical interval.

Acne scarring affects millions and can lead to poor self-esteem and psychosocial difficulties. Many patients seek treatment to improve the appearance of their skin. Acne scars range from mild to severe and are composed of shallow depressions, deep valleys, raised nodules, and pitting. The carbon dioxide laser is a frequently used modality for treating acne scarring. The laser is applied to the entire scarred area with particular emphasis on the shoulders of the depressed scars. By vaporizing the shoulder to a more gentle slope, less shadow is cast into the scar's depth, minimizing its appearance. It is the precision of the laser on these shoulders that reveals its advantage over other resurfacing techniques. In addition, contraction of the dermal collagen by the laser also tightens and stretches the scars, making them appear flatter and less obvious.

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PATIENTS AND METHODS

From June 4, 1995, to November 25, 1997, 25 patients underwent carbon dioxide laser ablation for the treatment of facial acne scarring. There were 4 male and 21 female patients involved in this study. Their ages ranged from 17 to 62 years. Follow-up ranged from 16 to 40 months (mean, 24 months; median, 28 months).

All patients were treated in an office ambulatory surgery setting with local anesthesia supplemented with intravenous sedation. The same scanning system (Sharplan 40c with SilkTouch flash scanner attachment; Sharplan Lasers, Inc, Allendale, NJ) was used in all cases.

At the final postoperative follow-up, patients and physicians were asked to complete an evaluation regarding treatment results in the 5 major aesthetic units of the face (forehead, temple, medial and lateral cheeks, and perioral region). In addition, the severity of acne scarring at baseline was also rated. A scale of 1 to 4 was used by physicians and patients to rate the degree of improvement and the degree of scarring.

Most of the literature¹⁻¹¹ on laser resurfacing has addressed the treatment response of facial rhytides. Few researchers^{12,13} have critically evaluated carbon dioxide laser treatment of acne scars and its variables. Anatomic location, as a variable, has been addressed in the treatment of facial rhytides⁸ but, to our knowledge, has not been evaluated in patients with acne scarring. In this article, we have attempted to define anatomic variables that would better predict the final cosmetic outcome of carbon dioxide laser resurfacing of facial acne scars.

RESULTS

Most patients in this study (n=15) underwent full-face laser ablation of acne scarring. The remaining patients (n=10) had isolated regions treated. Evaluations were performed on all patients by the treating physicians and by the patients themselves. Comparability of overall improvement and degree of scarring present preoperatively were assessed by the Fisher exact *t* test. Comparability of individual aesthetic units was assessed by the Wilcoxon rank sum test.

Most patients assessed their scarring as moderate. This finding correlated well with the physicians' assessments. There were no statistically significant differences for the degree of scarring rated by physician and by patient ($P=.09$, 1-tailed *t* test) (**Figure 1**). In addition, physicians and patients believed that an overall good to excellent result was achieved; once again, there were no statistically significant differences between physician and patient evaluations ($P=.87$, 2-tailed *t* test) (**Figure 2**).

Assessments of individual aesthetic units revealed significantly greater degrees of improvement on the forehead, perioral region, and medial cheek compared with

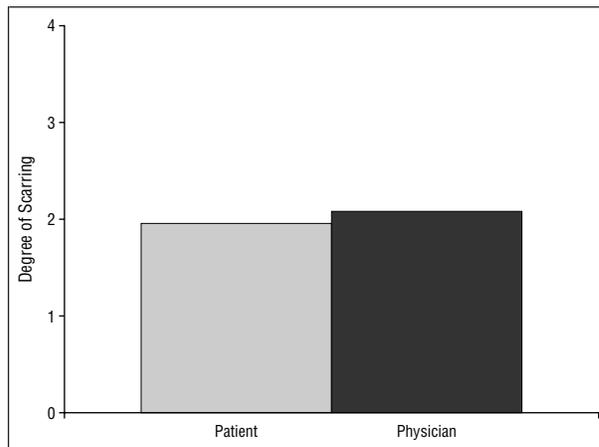


Figure 1. The degree of scarring preoperatively is similar when rated by patient and physician assessment. 0 indicates none; 1, mild; 2, moderate; 3, moderately severe; and 4, severe.

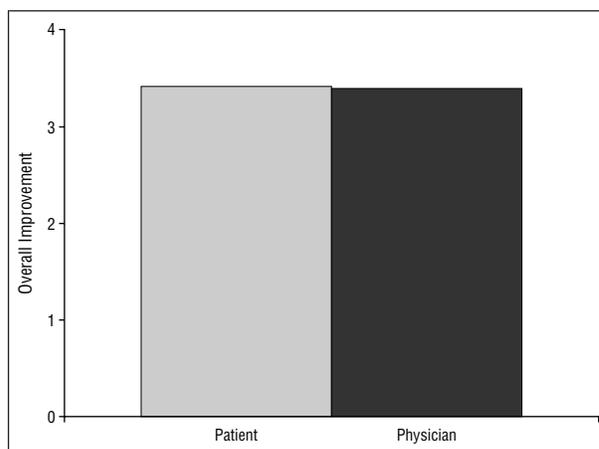


Figure 2. Overall improvement is rated good to excellent by patients and physicians. 0 indicates none; 1, poor; 2, fair; 3, good; and 4, excellent.

the temple and lateral cheek. Statistical analysis using the Wilcoxon rank sum test showed the greatest improvement to be when the perioral and medial cheek areas were compared with the lateral cheek ($P<.001$ for both) and when the forehead was compared with the temple ($P<.001$). **Figure 3** shows by region the degree of improvement, as determined by physician and patient.

No patients in this study experienced worsening of their scarring. There were no cases of prolonged hyperpigmentation or erythema persisting beyond 3 months. No postoperative infections were reported. All patients reported that they would undergo the laser treatment again to enhance further improvement. No patients were dissatisfied, although those with higher degrees of scarring believed additional treatment would be necessary.

Figure 4 illustrates a patient treated with the carbon dioxide laser for acne scarring. She demonstrates an overall greater degree of improvement, especially in the medial cheek, than the patient shown in **Figure 5**. The patient in Figure 5 has a much greater degree of acne scarring and also scarring involving less favorable areas (the lateral cheek and the temple).

COMMENT

The successful treatment of acne scarring has been one of the most elusive goals for practicing cosmetic surgeons. Aside from the psychological effect on patients, the pathological features associated with acne scarring ultrastructurally do not lend themselves readily to improvement. Unfortunately, information to assist the surgeon in predicting the likely outcome of treatment for acne scarring with the carbon dioxide laser is lacking. Surgeons lack the ability to adequately communicate to their patients the probable degree of improvement within anatomic sites. They have simply been left to rely on their own educated best guess, euphemistically termed *clinical judgment*. Earlier studies^{12,13} have demonstrated the

efficacy of the carbon dioxide laser for the treatment of acne scarring, but have never shown where it works best.

This study demonstrates that 3 anatomic areas—the forehead, the perioral region, and the medial cheek—

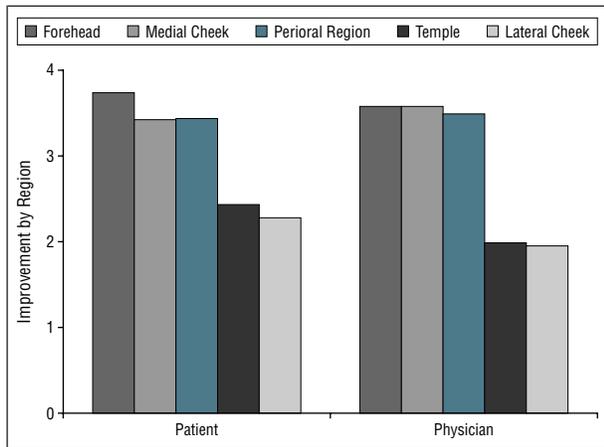


Figure 3. A greater improvement is seen in the forehead, medial cheek, and perioral region than in the temple and lateral cheek. 0 indicates none; 1, slight; 2, moderate; 3, good; and 4, excellent.



Figure 4. Top, A patient with mild to moderate degrees of scarring preoperatively. Bottom, The same patient after full-face carbon dioxide laser abrasion. There was marked improvement, especially in favorable anatomic areas.



Figure 5. Left, A patient with a moderately severe degree of acne scarring preoperatively. Right, The same patient after full-face carbon dioxide laser abrasion. There was a lesser degree of improvement than for the patient shown in Figure 4, especially in less favorable anatomic locations.

clearly show superior postoperative results than the temple and lateral cheek areas. This was the opinion of the patients and the evaluating physicians. Similar to previous studies,¹² the degree of improvement was considered from good to excellent by the patient and physician.

Questions raised by this study not addressed within would include the following: (1) Do certain areas of the face, such as the lateral cheeks and temple, present with more severe scarring, thus making them less likely to exhibit some degree of improvement postoperatively? (2) Do patients who present with scarring in less responsive areas tend to present with more severe scarring, making this population of patients less responsive to treatment as a whole? (3) Does the type of scarring not addressed in this study (nodular, ice picked, or depressed) have an effect on the outcome of certain areas? (4) Would a larger sample size have resulted in a more definitive *P* value and, therefore, increased the strength of this study? Although the answers to these questions remain to be proved, they are forthcoming.

In conclusion, it does appear that the carbon dioxide laser is an effective method for treating facial acne scarring. Patient and physician satisfaction appears to be high. Furthermore, patients with less severe acne scarring achieve greater degrees of improvement. Also, patients should be counseled to expect that certain areas of the face (forehead, medial cheek, and perioral region) will respond better than other regions of the face and that additional resurfacing procedures may be required.

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