ORIGINAL ARTICLE

Evaluation of Acne Scar Treatment With a 1450-nm Midinfrared Laser and 30% Trichloroacetic Acid Peels

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Objective: To evaluate the efficacy of treatment of established acne scars with a sequential combination of treatment using a 1450-nm, midinfrared, nonablative diode laser with dynamic cooling spray and 30% trichloroacetic acid peels.

Methods: In this prospective study 9 patients with atrophic rolling, boxcar, or both types of scars received 4 monthly treatments using a 1450-nm, midinfrared, nonablative, diode laser with dynamic cooling spray followed by 2 bimonthly treatments with 30% trichloroacetic acid peels. Blinded evaluators and the patients rated the results.

Results: The group of patients in this study had a greater improvement in their acne scars than has been reported for nonablative laser treatments by other authors. Comparing the results of treatment 2 months after the laser treatments with 2 months after the chemical peels, the patients had a greater improvement after the additional chemical peels. There were no complications in this study. The patients were able to continue all of their regular activities throughout the study.

Conclusion: This sequential treatment regimen using the 1450-nm, midinfrared, nonablative diode laser with dynamic cooling spray and 30% trichloroacetic acid peels produced a noticeable improvement in the acne scars without any associated morbidity.

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ACNE IS A COMMON DISORder, which affects the vast majority of people usually between the ages of 11 and 30 years. Many of the affected individuals develop noticeable scarring that typically persists unless it is treated. These facial scars can lead to embarrassment and loss of self-esteem,[1] and they may also inhibit interpersonal interactions.

In the past, treatment of acne scars frequently involved ablative modalities such as dermabrasion or laser resurfacing that, while improving the appearance of the scars,[2] have associated prolonged recovery, morbidity, and risks of complications.[3-5] More recently, physicians have started to use nonablative lasers for treatment of these scars.[6-10]

Historically, most patients will not have their scars treated. This may be owing to not wanting to deal with the associated risks of the more familiar ablative procedures. They also may not have the available time required for the prolonged recovery from these procedures. Recently, nonablative, collagen-stimulating lasers have become available to treat acne scars.[6-10] Because the epidermal injury is minimized with these lasers, they do not have the associated prolonged recovery that occurs with resurfacing lasers. These nonablative lasers are designed to spare the epidermis and stimulate the dermis to produce new collagen.

Using this type of technology alone, the improvements seen on the skin surface are a reflection of the effects on the dermal collagen below.[11] This limits the amount of visible improvement. It is our hypothesis that to maximize the visible improvement from nonablative lasers the upper layer of the skin must also be treated.[12,13]

This study was designed to assess the results that could be achieved by sequentially combining 2 modalities. The first modality used was the 1450-nm, midinfrared, nonablative diode laser with dynamic cooling spray (SmoothBeam; Candela Corporation, Wayland, Mass). This laser exerts its effect on the dermis between 100 and 500 µm of depth. In subsequent treatments, 30% trichloroacetic acid peels were used to treat the upper 100 µm of skin. By combining these 2 modalities both the skin surface and the underlying dermis are treated to improve the acne scars with minimal "down time" for the patients.

METHODS

Ten patients were enrolled in the study. Nine of 10 patients completed the study. One patient did not complete all of the required treat-

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Figure 1. Patient with boxcar and rolling acne scars before (A) and after (B) treatment.

Figure 2. Patient with rolling and excoriation acne scars before (A) and after (B) treatment. The hypopigmentation associated with the excoriation scars persisted after treatment as anticipated; however, the depth of these scars is significantly diminished.

ments owing to schedule conflicts and, therefore, is excluded from these data. Patients with only sharply marginated scars, such as ice pick scars as well as patients with hypertrophic scars were not enrolled in the study. Patients with significant rolling or boxcar scars[14] were included. Additionally, all patients were Fitzpatrick skin types II and III. Initially each patient's scars were rated for the types of scars and the extent of scarring on a 0- to 10-point scale. Digital photographs were taken before any treatment was initiated, 2 months after the laser treatment was completed, and 2 months after the chemical peels at the completion of the study. These photographs were used by the blinded evaluators to assess the results. The evaluators were independent in that they did not participate in conducting the study and did not know the patients.

The patients studied had multiple acne scars for years. As is typical for well-established scars, the scars would persist with minimal or no change without intervention. As such, each patient's baseline was used as their own control.[15] Furthermore, as part of the posttreatment evaluation, the before and after photographs were randomized and unlabeled. Thus, each of the 2 evaluators first had to distinguish between the pretreatment and posttreatment photographs and then assess the improvement.

Each patient was enrolled in the treatment protocol. This protocol and study were reviewed, followed up, and approved by the Western Institutional Review Board, Olympia, Wash, throughout the course of the study.

Patients first received a series of 4 monthly treatments with the midinfrared 1450-nm nonablative diode laser with dynamic cooling spray (SmoothBeam). Before each treatment 4% lidocaine hydrochloride (LMX4; Ferndale Laboratories, Ferndale, Mich) was first applied for topical anesthesia for at least 45 minutes. Test spots were then made and the patient's skin was observed for 15 minutes. If the patient tolerated the test spots well, the treatment was then performed. The laser was used at a fluence of 12 to 13 J/cm^2. The dynamic cooling spray varied from 30 to 40 milliseconds. Each patient received 4 laser treatments at monthly intervals. Two months after the fourth laser treatment, the first 30% trichloroacetic acid peel was performed. Two months later a second 30% trichloroacetic acid peel was performed. Two months after the second peel the final evaluation was performed.

Photographs were taken after the laser treatments were completed, before the first trichloroacetic acid peel, and at the final evaluation 2 months after the second chemical peel. At that time the patients were asked to evaluate the results. Two blinded evaluators compared and rated the photographs that were taken at the beginning and end of the study. After identifying the pretreatment and posttreatment photographs, they were asked to

Table 1. Evaluators A and B and Patient Self-assessment—Overall Result*

Patient No./ Sex/Age, y	Extent of Acne Scarring		Mean Extent of Scarring	Assessment of Overall Improvement		Patient Self-assessment	Mean Evaluation Rating
	Evaluator A	Evaluator B		Evaluator A	Evaluator B		
1/F/23	3.0	3.0	3.0	6.0	9.0	3.0	7.5
2/F/39	3.0	3.0	3.0	7.0	10.0	5.0	8.5
3/F/53	2.0	4.0	3.0	4.0	9.0	8.5	6.5
4/F/47	4.0	4.0	4.0	6.0	8.0	8.0	7.0
5/F/32	6.0	4.0	5.0	5.0	5.0	5.0	5.0
6/F/58	4.0	6.0	5.0	7.0	7.0	8.0	7.0
7/F/33	8.0	5.0	6.5	7.0	9.0	9.0	8.0
8/M/39	8.0	8.0	8.0	5.0	7.0	7.0	6.0
9/M/46	8.0	8.0	8.0	5.0	7.0	4.0	6.0
Mode	8.0	4.0	3.0	7.0 and 5.0	7.0	8.0	6.0 and 7.0
Mean	5.1	5.0	5.1	5.8	7.9	6.4	6.8
Median	4.0	4.0	5.0	5.0	8.0	7.0	7.0

*All evaluations were rated on a 10-point scale with 0 indicating no improvement and 10, complete resolution.

Table 2. Evaluator C—Extent of Scarring by Type*

Patient No.	Extent of Scarring							
	Initial		After Laser, Before Skin Peel		Final Outcome		Change	
	Rolling	Boxcar	Rolling	Boxcar	Rolling	Boxcar	Rolling	Boxcar
1	3.0	3.0	1.5	1.5	1.0	1.0	2.0	2.0
2	4.0	1.0	2.0	0.5	0	0.5	4.0	0.5
3	6.0	2.0	4.5	2.0	3.0	1.0	3.0	1.0
4	5.0	4.0	3.0	2.0	2.0	2.0	3.0	2.0
5	5.0	5.0	2.5	4.0	2.0	3.0	3.0	2.0
6	5.0	1.0	4.0	1.0	3.0	1.0	2.0	0
7	8.0	1.0	4.5	1.0	3.0	1.0	5.0	0
8	9.0	7.0	4.5	4.0	4.0	4.0	5.0	3.0
9	9.0	7.0	4.0	4.0	4.0	4.0	5.0	3.0
Mean (SD)	7.7 (2.2)	3.4 (2.5)	3.4 (1.2)	2.2 (1.4)	2.4 (1.3)	1.9 (1.4)	3.6 (1.2)	1.5 (1.2)
Median	5.0	3.0	4.0	2.0	3.0	1.0	3.0	2.0

*All evaluations were rated on a 10-point scale with 0 indicating no acne scarring and 10, severest acne scarring.

rate the results, using a 0- to 10-point scale. A third, blinded evaluator (J.V.) analyzed the results after the laser treatments and after the chemical peels to assess the relative contribution of each modality.

RESULTS

Regardless of the extent and type of scarring, all of the study patients had noticeable improvement in the appearance of their acne scars as rated by both the evaluators and the patients who participated in the study. The amount of improvement was readily visible in that the evaluators were readily able to distinguish unlabeled prestudy and poststudy photographs (**Figure 1** and **Figure 2**).

The patients consistently noted a significant improvement. Their mean improvement self-assessment score was 6.4 on a scale of 0 to 10, with an SD of 2.18 and a median of 7.

Independent evaluators also assessed the patients' results on a scale of 0 to 10. Between the 2 evaluators, the mean (SD) improvement of all the patients was 6.8 (1.1) with a median of 7. This is similar to the patients' assessments. The evaluators were unaware of the patient's opinions about their results.

Table 3. Summary of Results by Scar Type*

Variable	Score
Mean extent of initial scarring	
Rolling	7.7
Boxcar	3.4
Mean extent of final scarring	
Rolling	2.4
Boxcar	1.9
Mean improvement of scarring	
Rolling	5.3
Boxcar	1.5
Improvement, %	
Rolling	0.68
Boxcar	0.44

*All evaluations were rated on a 10-point scale with 0 indicating no improvement and 10, complete resolution.

Table 4. Separation of Results—Laser and Chemical Peel*

Type of Acne Scarring	Mean Values: Before Laser Treatment	Laser's Improvement, %	After Laser, Before Skin Peel	Peel's Improvement, %	After Both Treatments
Rolling	7.7	4.3	3.4	1.0	2.4
Boxcar	3.4	1.2	2.2	0.3	1.9

*All evaluations were rated on a 10-point scale with 0 indicating no improvement and 10, complete resolution.

Results were also assessed based on the type of scarring evident in each patient. Mean values of the extent of scarring (rated from 0-10) by type of scar (rolling, boxcar, or both) were calculated before and after the entire treatment. By subtracting these values, the mean improvement of each was determined. The mean improvement of rolling scars was 5.3 while the mean improvement of boxcar scars was 1.5. Although it is evident that the combination laser and chemical peel treatments had a greater effect on rolling scars, boxcar scars were also significantly improved.

Finally, to evaluate the efficacy of the 1450-nm, midinfrared, nonablative diode laser and the 30% trichloroacetic acid peel separately, additional assessments of the extent of scarring were performed by another independent evaluator (J.V.) after the laser treatment and before the chemical peel. These assessments were also separated according to type of scarring. Differences between these intermediate assessments and initial and final assessments determined the laser's relative contribution and the chemical peel's relative contribution to overall improvement. For rolling scars, there was an improvement of 4.3 points with the laser and an additional 1.0 point with the chemical peel. For boxcar scars, results showed an improvement of 1.2 points with the laser and an additional 0.3 of a point with the chemical peel. As the aforementioned results illustrate, the chemical peel provides an essential, additional amount of improvement (**Tables 1, 2, 3, and 4**).

COMMENT

All of the patients in this study had a noticeable improvement in their acne scars and were pleased with the results of this combined therapy. This was both on their subjective evaluations as well as the independent evaluations. The percentage of improvement was greater than has been reported for nonablative lasers alone.[7,8] The improvement in acne scars was also comparatively greater than has been reported for nonablative laser treatment of rhytids.[16-18] Three of the patients were so pleased with the results that they requested additional laser and chemical peel treatments beyond the study. The 4 laser treatments consistently produced a noticeable improvement. The subsequent chemical peels consistently yielded additional improvement. As described, these chemical peels were relatively superficial as the goal was only to treat just beyond the superficial 100 µm of the skin that was not directly treated by the laser. This differs from studies treating acne scars with chemical peels in which the peels were significantly deeper.[12,13] Typically after this chemical peel the patients developed 1 to 4 days of superficial crusting, which did not limit their activities, followed by 1 to 4 days of mild pinkness.

There were no significant complications in any of the study patients or in the one patient who did not complete the study. However, previous studies with nonablative lasers have reported problems such as procedural pain and hyperpigmentation.[7,17] The lack of procedural pain was due to the application of 4% lidocaine hydrochloride at least 45 to 60 minutes before treatment with the laser. All of the patients were able to continue their regular activities throughout the study, as there was no associated morbidity.

CONCLUSIONS

Significant improvement in the appearance of atrophic acne scars can be achieved with a sequential temporally staged regimen using the 1450-nm, midinfrared, nonablative diode laser and 30% trichloroacetic acid peels. In this study there was no associated morbidity and, therefore, the patients did not lose any time from their regular activities. Considering these results, 1 of us (P.J.C.) prefers this regimen to resurfacing modalities for the treatment of acne scars. In the future as other technology or techniques become available, this may change.

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