

# Treatment of Perioral Rhytides

## *A Comparison of Dermabrasion and Superpulsed Carbon Dioxide Laser*

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**Objective:** To directly compare the cosmetic outcome and adverse effects of dermabrasion and superpulsed carbon dioxide laser for the treatment of perioral rhytides.

**Design:** Subjects were randomly assigned to receive treatment with carbon dioxide laser resurfacing to one side of the perioral area and dermabrasion to the other side in a prospective, comparative clinical study. The duration of follow-up by blinded observers was 4 months.

**Setting:** University hospital-based dermatologic surgery clinic.

**Patients:** Fifteen healthy fair-skinned volunteers with moderate to severe perioral rhytides and no history of prior cosmetic surgical procedures to the same anatomic area.

**Interventions:** One half of the perioral area was treated with the LX-20SP Novapulse carbon dioxide laser (Luxar Corp, Bothell, Wash), and the other half was treated with dermabrasion using either a hand engine-driven diamond fraise or a medium-grade drywall sanding screen (3M Corp, St Paul, Minn).

**Main Outcome Measures:** Improvement in rhytides, patients' subjective reports of postoperative pain, time to reepithelialization, degree of postoperative crusting, and duration of postoperative erythema were observed for both methods. Standardized scoring systems were used to quantify outcome measures. Paired *t* tests were used for statistical comparisons of the 2 resurfacing methods.

**Results:** The difference in rhytide scores for the 2 methods was not statistically significant ( $P = .35$ ) at 4 months. Less postoperative crusting and more rapid reepithelialization were noted with the dermabrasion-treated skin. Postoperative erythema was of longer duration on laser-treated skin. Patients reported less pain with dermabrasion treatment. Subtle differences that were difficult to quantify were also noted between the methods.

**Conclusions:** Both dermabrasion and carbon dioxide laser resurfacing are effective in the treatment of perioral rhytides. Both methods have unique advantages and disadvantages.

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**P**ERIORAL RHYTIDES can be successfully treated with various resurfacing methods, including dermabrasion and carbon dioxide laser. Specific advantages and disadvantages of the 2 methods are well known.

Dermabrasion has a long history of success in the treatment of wrinkles and scars. It has recently fallen out of favor because many surgeons have found carbon dioxide lasers to be more predictable as to the depth of tissue injury, and lasers are easier to master. Advantages of dermabrasion include the relatively low cost of equipment. Disadvantages include potential exposure of health care personnel to blood-borne pathogens aerosolized by the dermabrading fraise.

Pulsed and scanned carbon dioxide laser methods also have potential risks. As with dermabrasion, scarring, infection, prolonged erythema, transient hyperpigmentation, and

prolonged hypopigmentation are potential complications. Laser equipment is more costly to purchase and maintain. Risks to the operator include potential exposure to infectious agents in the laser plume and ocular injury when adequate safety precautions are neglected. However, there is less potential for blood exposure.

*For editorial comment  
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The dermabrasion and carbon dioxide laser methods have been compared in only a few published studies.<sup>1,2</sup> Fitzpatrick et al<sup>1</sup> found dermabrasion-treated skin and carbon dioxide laser-treated skin to have similar courses of healing both clinically and histologically in a porcine model.

The goal of our study was to directly compare the cosmetic outcome and complications of the 2 methods in human sub-

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## PATIENTS AND METHODS

### PATIENTS

Fifteen patients with rhytides around the mouth area were enrolled in the study to receive treatment with dermabrasion to one half of the perioral area and carbon dioxide laser resurfacing to the other half. Patients were recruited from the community via advertisements in local newspapers and from our dermatologic surgery practice at the Boston University Medical Center, Boston, Mass. Inclusion criteria were ages from 25 to 75 years, ability to provide informed consent in English, fair skin (Fitzpatrick skin phototypes I-III<sup>3</sup>), and symmetric rhytides in the perioral area. Exclusion criteria included a history of cosmetic surgery to the anatomic area, including resurfacing procedures (ie, laser, dermabrasion, and chemical peel), cosmetic tattoos, implantation of synthetic materials, and implantation of collagen or autologous fat within the past year. Additional exclusion criteria were active skin disease in the perioral area (ie, acne), immunosuppression, human immunodeficiency virus (HIV) or hepatitis infection, diabetes mellitus, active psychiatric illness, tobacco use, bleeding disorder, history of poor wound healing or abnormal scarring, pregnancy, isotretinoin (Accutane; Hoffman-LaRoche, Nutley, NJ) use within the past 2 years, active herpes simplex infection at the time of surgery, and concurrent participation in other research studies. The Institutional Review Board for Human Research at Boston Medical Center approved our research project.

Potential enrollees were interviewed briefly over the telephone. If they met the inclusion and exclusion criteria and were interested in hearing more about the study, they were invited for a face-to-face interview and evaluation. Risks and benefits of the procedure were reviewed in detail at this time, and patients were given copies of consent forms. Rhytide scores and Fitzpatrick phototypes were determined. The rhytide score was determined based on comparison with a series of 5 standardized photographs showing wrinkles of increasing depths, grade 1 being the mildest and grade 5 the deepest. All patients returned for a final preoperative visit 2 to 3 weeks before the date of surgery. Consent forms were signed during this visit. Two weeks

prior to surgery, each subject began a twice daily topical pretreatment regimen of 0.025% tretinoin cream (Retin-A; Ortho Pharmaceutical Corp, Raritan, NJ) at bedtime and 4% hydroquinone cream with sunscreens (Solaquin Forte; ICN Pharmaceuticals Inc, Costa Mesa, Calif). Subjects received oral doses of antiviral prophylaxis that consisted of famciclovir, 125 mg, or acyclovir, 400 mg, 2 times a day for 5 days beginning the day before surgery and oral doses of antibiotic prophylaxis that consisted of cephalexin, 250 mg, 4 times a day for 5 days beginning the morning of the surgical procedures.

### CARBON DIOXIDE LASER AND DERMABRASION PROCEDURES

Both procedures were completed during the same treatment session. All patients received treatment on 1 of 2 consecutive days. A team of 2 physicians using uniform technique performed all procedures (K.A.H. and G.S.R.). Preoperative and immediate postoperative photographs of the perioral area were taken on the day of surgery using uniform photographic technique. The perioral area was anesthetized with a combination of infraorbital and mental nerve blocks and local infiltration with 0.5% lidocaine hydrochloride with epinephrine, 1:100000. The skin was prepared with chlorhexidine gluconate. Damp gauze and sterile surgical towels were placed around the surgical field and over the patients' eyes.

The right and left halves of the perioral area were randomly assigned to receive 1 of the 2 procedures on the day of surgery. An envelope containing a specific assignment was opened for each patient. It was then sealed and placed in the patient's chart for the remainder of the study.

The carbon dioxide laser system used in the study was the LX-20SP Novapulse (Luxar Corp, Bothell, Wash). The Novascan E8 exposure program with a power setting of 5 W or 6 W was used for each pass. This program produces rapid superpulses of extremely short duration that are clustered together into bursts. The dwell time (pulse width) is approximately 500 microseconds. The fluence (energy density) is 4.24 J/cm<sup>2</sup>. A spinning pie-shaped 0.7-mm spot creates 3-mm circular scans. Each scan is completed in 60 milliseconds. The operator keeps the handpiece in continuous

jects. To control for intersubject variation, the 2 techniques were applied to opposite sides of the same anatomic area (the perioral area) in each subject.

### RESULTS

Patients ranged in age from 46 to 73 years (mean, 59 years). All participants were women. The mean preoperative rhytide score was 3.73 (SD, 0.88). All patients were judged to have the same score on the 2 halves of the perioral area.

The wounds created by dermabrasion showed more bleeding during the immediate postoperative period (**Figure 1**). Subjective reports of pain were on average slightly greater for the carbon dioxide laser-treated side, although the difference was not statistically significant ( $P = .13$ ) (**Table**). Patients were asked to rate their pain at each follow-up visit during the first 2 weeks, and the highest score for each treatment area was used for the

analysis. Individual reports of pain for each method were highly variable, ranging from 1 (no pain) to 4 (severe pain). Patients reported the greatest amount of pain during the first 48 hours. No patients required pain medication other than acetaminophen.

Crusting was more extensive on carbon dioxide laser-treated skin, and the difference between the 2 methods was statistically significant ( $P = .002$ ) (**Table**). The mean crusting scores were highest at the 2-day follow-up visit. An example of the difference in postoperative crusting is shown in **Figure 2**. Again, there was significant individual variation, with crusting scores ranging from 1 (none) to 4 (severe). Patients with heavier crusting were encouraged to cleanse their wounds more aggressively and subsequently improved. A difference in reepithelialization is illustrated in **Figure 3**. Differences in reepithelialization for the 2 methods are represented in **Figure 4**. Statistical analysis was not possible for this outcome measure since the ex-

motion so that minimal overlap occurs between adjacent scans. The scans were delivered at frequency of 8 per second. With the power settings used, 300 to 360 mJ was delivered with each scan. Two passes were completed to the entire treatment area. A third pass was completed to the shoulders of any residual rhytides. Devitalized tissue was removed using saline-soaked gauze between passes. No subject received more than 3 passes.

Dermabrasion was performed on 8 patients using an engine-driven 17 × 8-mm cylinder-shaped coarse diamond fraise (Robbins Instruments Inc, Chatham, NJ). On the remaining 7 patients, dermabrasion was performed using a medium-grade drywall sanding screen (3M Corp, St Paul, Minn). Assignment to method was randomized. Cryogen spray was not used with either technique. All patients receiving treatment on a given day received the same method of dermabrasion. The method of manual dermabrasion using drywall sanding screen has been described in detail by Zisser et al.<sup>4</sup> The dermabrasion was continued until uniform pinpoint bleeding was noted throughout the treatment area and smaller rhytides were effaced. Hemostasis was obtained with pressure. The same team of physicians completed all of the procedures.

Both halves of the perioral area were cleansed with sterile saline solution and dressed with Aquaphor healing ointment (Beiersdorf Inc, Wilton, Conn). All patients followed the same postoperative care regimen, which consisted of frequent (at least 5 times daily) cleansing with tap water and reapplication of the Aquaphor ointment. After reepithelialization, patients were instructed to daily apply to the treatment area a sunscreen with a sun protection factor of at least 15. They were encouraged to avoid unnecessary sun exposure.

#### OUTCOME PARAMETERS

Patients were seen for follow-up at the following points in the postoperative period: 2 days, 1 week ( $\pm 1$  day), 2 weeks ( $\pm 2$  days), 1 month ( $\pm 3$  days), 2 months ( $\pm 1$  week), and 4 months ( $\pm 1$  week). At the time of each evaluation, 2 blinded observers completed the evaluation outlined below. The observers were 2 laboratory technicians with training and experience from previous resurfacing studies in our depart-

ment. Outcome parameters were determined during the actual examination of the patient, not from photographs. The observers examined each subject together until they agreed on all the scores. During the first 2 weeks, patients were evaluated for the following: degree of crusting, degree of erythema, and the extent of reepithelialization. Crusting and erythema were graded on a scale of 1 to 4 (1, none; 2, mild; 3, moderate; and 4, severe). Reepithelialization was judged to be either complete or incomplete. During this period, patients were asked to subjectively report pain on the 2 sides of their face, using the same grading system. At all visits, patients were examined for evidence of scarring, infection, and other complications. Photographs of the perioral area were taken at each visit.

At the 1-, 2-, and 4-month follow-up visits, erythema and hyperpigmentation were graded on the same 1-to-4 scale. The rhytide score was again determined based on direct comparison with a standardized series of photographs (1 [mild] to 5 [severe]). At the 4-month follow-up visit, each patient was asked which side of the perioral area, if either, appeared more improved. The blinded observers also made this determination. This same pair of blinded observers determined outcome scores for each subject at every visit.

#### DATA ANALYSIS

The study design and number of research subjects resulted in 80% power to detect a difference of 0.5 in postoperative rhytide scores at  $P = .05$ . Nonparametric paired tests (Wilcoxon signed rank test) were used to compare various characteristics of dermabrasion-treated skin and carbon dioxide laser-treated skin. Specifically, the maximum amount of postoperative pain and crusting was compared during the first 2 weeks. Erythema was compared at each time point from week 1 onward. Hyperpigmentation was compared at 1, 2, and 4 months. Wrinkle scores were compared at 4 months. Duration of postoperative erythema, time required for reepithelialization, and patient and observer opinions regarding overall best result were expressed as proportions. The statistical analyses were performed using SAS software (SAS Institute, Cary, NC) licensed to Boston University.

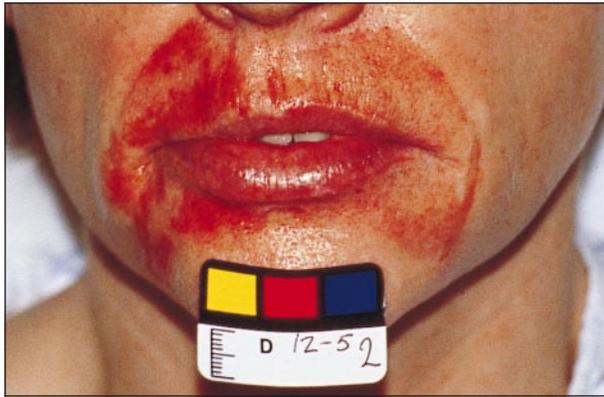
act day of reepithelialization was not known for each patient. For both methods, reepithelialization was complete in some individuals by the 1-week follow-up visit. All of the dermabrasion-treated areas and all but one of the laser-treated areas were fully reepithelialized by the 2-week follow-up visit.

Erythema was more pronounced at all points in time on laser-treated skin. The difference in erythema score was statistically significant at 1 week ( $P = .003$ ), 2 weeks ( $P = .001$ ), and 1 month ( $P = .003$ ) but not at 2 or 4 months ( $P = .19$  and  $P = .15$ , respectively) (Table). A typical case at 1 month is shown in **Figure 5**. Differences in the duration of postoperative erythema are represented in **Figure 6**. Scarring, infection, and postoperative hyperpigmentation did not occur in any of the research subjects.

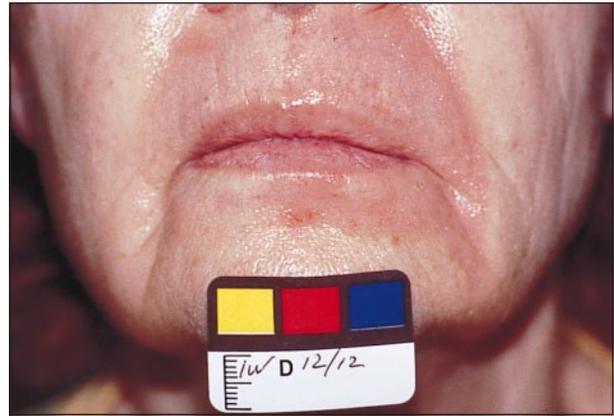
One patient, for reasons unrelated to the study, was unable to return for the 2- and 4-month evaluations. By telephone, she denied experiencing any complications and

was pleased with the outcome. Another patient missed her 1- and 2-month follow-up visits because of unanticipated travel. Data analysis was restricted to results gathered by the blinded observers during actual patient visits.

Both treatment methods resulted in statistically significant improvement in the rhytide score ( $P = .001$  for dermabrasion and  $P = .002$  for carbon dioxide laser). The mean rhytide score at 4 months was slightly lower for laser-treated skin; however, the difference in scores between the 2 methods was not statistically different ( $P = .35$ ) (Table). The mean postoperative rhytide score was 2.64 for laser-treated skin and 2.79 for dermabrasion-treated skin. The mean decrease in rhytide score was 1.09 for laser-treated skin and 0.94 for dermabrasion-treated skin. **Figure 7** shows a patient with more improvement on the laser-treated side. **Figure 8** shows a patient with equal improvement on both sides. When comparing the 2 treatment areas side-by-side, subtle differences were noted that



**Figure 1.** Appearance of a typical patient immediately after undergoing the dermabrasion and superpulsed carbon dioxide laser procedures. Greater hemostasis is apparent on the right side of the photograph (patient's left), where the carbon dioxide laser treatment was performed.



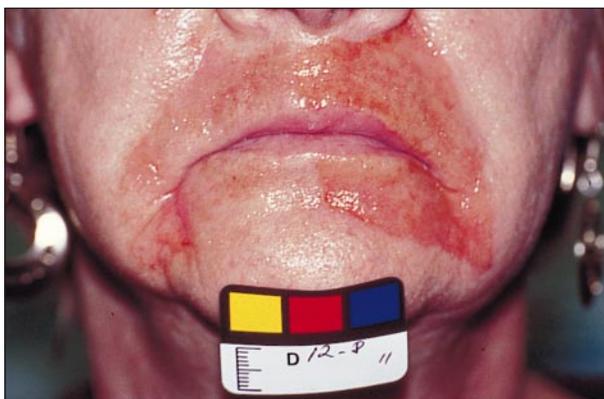
**Figure 3.** At 1 week, the dermabrasion-treated skin on the left side of the photograph (patient's right) is fully reepithelialized, whereas the carbon dioxide laser-treated skin on the opposite side is still healing in a few areas. The laser-treated skin shows more postoperative erythema.

#### Outcome Scores for 14 Women Who Underwent Dermabrasion and Carbon Dioxide Laser Treatments

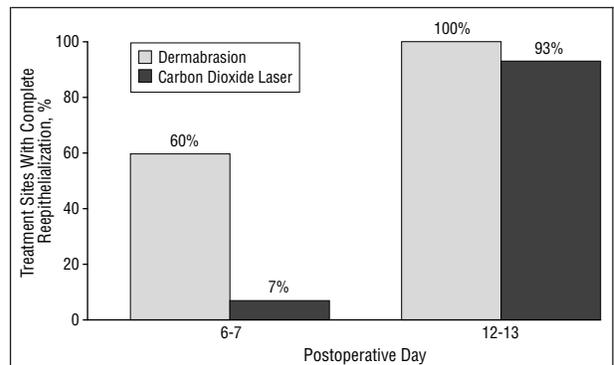
Outcome Measure	Score, Mean ± SD		P
	Dermabrasion	Carbon Dioxide Laser	
Maximum pain score*	1.93 ± 0.80	2.20 ± 0.86	.13
Maximum crusting score*	1.80 ± 0.86	2.47 ± 0.83	.002†
Erythema score*			
1 wk	2.13 ± 0.35	2.87 ± 0.35	.003†
2 wk	2.00 ± 0.00	2.80 ± 0.41	<.001†
1 mo	1.36 ± 0.50	2.07 ± 0.47	.003†
2 mo	1.15 ± 0.38	1.46 ± 0.52	.19
4 mo	1.00 ± 0.00	1.21 ± 0.43	.15
Rhytide score, 4 mo†	2.79 ± 0.58	2.64 ± 0.63	.35

\*The grading system for erythema, pain, and crusting was 1, none; 2, mild; 3, moderate; and 4, severe. The grading system for rhytides was 1, mild; 2, mild-moderate; 3, moderate; 4, moderate-severe; and 5, severe. The mean pretreatment score was 3.73 ± 0.88.

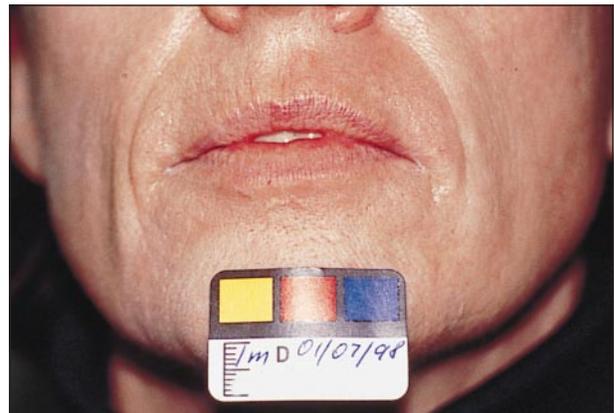
†Statistically significant (as determined by Wilcoxon signed rank test).



**Figure 2.** The patient shows a noticeable difference in the degree of crusting on postoperative day 2. The dermabrasion-treated skin on the left side of the photograph (patient's right) appears cleaner. The carbon dioxide laser-treated skin on the opposite side is covered with mild crust.



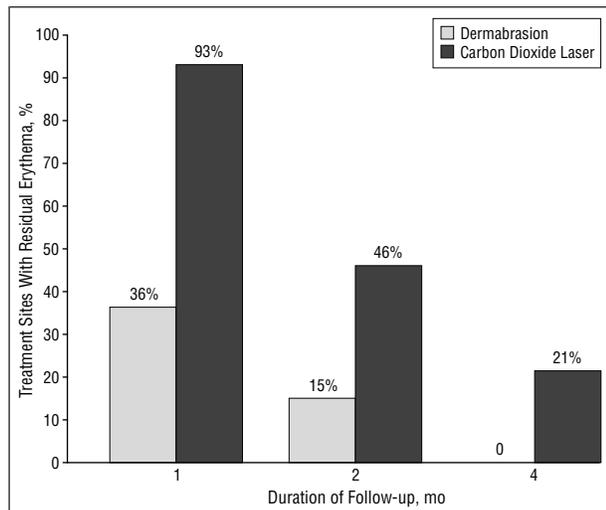
**Figure 4.** Percentage of treatment sites showing complete reepithelialization on postoperative day 6 or 7 and again on postoperative day 12 or 13. Dermabrasion-treated skin healed more rapidly.



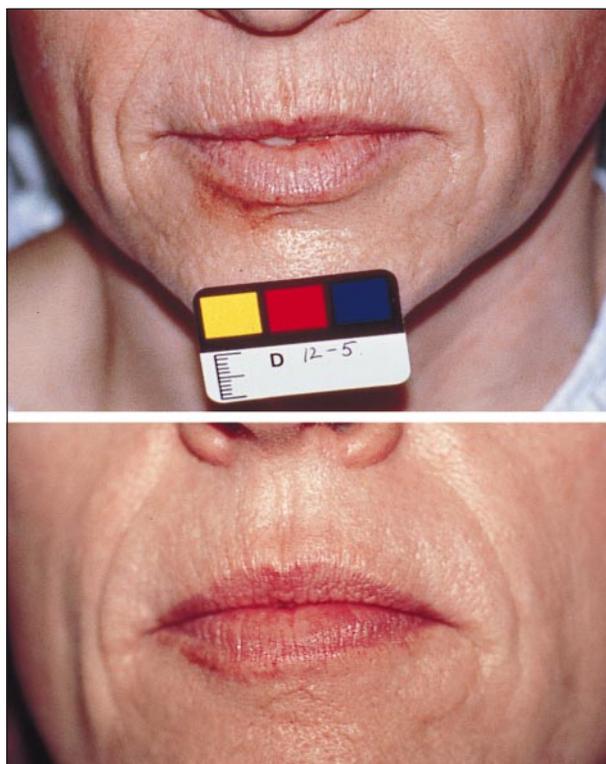
**Figure 5.** At 1 month, carbon dioxide laser-treated skin, on the right side of the photograph (patient's left), shows mild erythema. Erythema on the dermabrasion-treated side has resolved entirely.

could not be quantified using any of our outcome parameters. Fine rhytides were more responsive to the treatments than deeper rhytides. The texture of laser-treated skin appeared smoother in some patients. Dermabrasion-

treated skin retained more of the preoperative "lumpy" or "elastotic" appearance in a few subjects who showed similar improvement in rhytides with the 2 methods. The subset of subjects with the most severe wrinkles (preoperative wrinkle scores >3) was analyzed separately. The difference in rhytide scores for the 2 methods was not statistically significant ( $P=.35$ ) in this subset of 9 individuals at 4 months.



**Figure 6.** Percentage of treatment sites with residual postoperative erythema. Erythema was present in more carbon dioxide laser-treated areas at every follow-up point in the study. Prolonged postoperative erythema occurred only after carbon dioxide laser treatment.



**Figure 7.** Preoperative (top) and 4-month postoperative (bottom) photographs of a patient for whom carbon dioxide laser treatment resulted in a better cosmetic outcome. Dermabrasion was performed on the right half of the perioral area (left side of each photograph) using an engine-powered diamond fraise.

Subjective opinions regarding superior cosmetic outcome were similar for patients and blinded observers. Seven of the 14 patients selected the laser-treated side as more improved at the 4-month follow-up visit. One patient believed the dermabrasion-treated side looked better. The remaining 6 patients did not see a difference between the sides. Blinded observers preferred the laser-treated side in 6 cases, preferred the derm-



**Figure 8.** Preoperative (top) and 4-month postoperative (bottom) photographs of a patient for whom dermabrasion and carbon dioxide laser treatments produced similar results. Dermabrasion was performed on the left half of the perioral area (right side of each photograph) using a diamond fraise.

abrasion-treated side in 1 case, and stated no preference in the remaining 7 cases.

#### COMMENT

With our study design we were able to directly compare dermabrasion and carbon dioxide laser resurfacing of the upper and lower lips in a side-by-side fashion. Our study demonstrated wide variation among subjects with respect to wound healing and complications, such as postoperative erythema and cosmetic outcome. These individual differences challenge the usefulness of comparative studies in which subjects receive only 1 of 2 treatments.

Some of the differences between the 2 methods we noted were anticipated based on previously published literature and our own experience. For example, prolonged postoperative erythema was observed only with carbon dioxide laser treatment in our study. This has been demonstrated in many other studies<sup>5-9</sup> and is believed to correlate with the depth of tissue ablation. We did not make any effort to histologically grade the injuries created by the resurfacing methods used in our study.

The immediate postoperative appearance of the 2 wounds was quite different. The wound created by the carbon dioxide laser showed greater hemostasis. Again, this was expected. Since the wavelength of the carbon dioxide laser (10 600 nm) is strongly absorbed by water, tissue heating and destruction result, effectively sealing off capillaries. The intraoperative shrinkage of tissue that

is observed most commonly during the second pass of laser resurfacing is also attributable to the physical properties of the carbon dioxide laser. The tissue is instantly desiccated and the uppermost layer of residual collagen is denatured. Kirsch et al<sup>10</sup> demonstrated increased collagen fiber diameter and loss of normal collagen fiber banding periodicity after pulsed carbon dioxide laser irradiation in the zone of residual thermal collagen damage. It is unclear if these altered fibers are responsible for any of the long-term changes that are seen with laser resurfacing. Wounds produced by dermabrasion show uniform hemorrhage during the immediate postoperative period, and no shrinkage of tissues is seen intraoperatively. Presumably, the uppermost layer of the dermabrasion wound is more viable.

Differences in healing for the 2 methods unfolded during the study. Dermabrasion resulted in cleaner wounds that reepithelialized more quickly. Although less drainage was noted on laser-treated skin immediately following surgery, the wounds appeared equally moist after several days. Postoperative pain was not significantly different, although there was a trend toward less pain with dermabrasion treatment. One reason why a laser-produced wound might demonstrate increased sloughing and crusting is that the uppermost layer of thermally damaged skin is nonviable and eventually sloughs after serving for a period as a biological dressing. In a study comparing the carbon dioxide laser method with a medium-depth chemical peel method for the treatment of periorbital wrinkles, Reed et al<sup>11</sup> found slower healing in patients who were treated with the carbon dioxide laser. Another explanation is that the depth of tissue injury for the 2 methods is actually different. Nehal et al<sup>12</sup> compared the carbon dioxide laser and dermabrasion methods in the revision of surgical scars. Interestingly, they noted more postoperative crusting on the halves of the scars that were treated with dermabrasion, a result opposite to ours. However, clinical improvement was comparable. Photodamaged skin and scar tissue may behave differently with the 2 resurfacing methods.

Several changes occur during the postoperative course of either procedure that may influence the appearance of rhytides. Early in the postoperative course, when erythema is quite noticeable, the side with more erythema may show more improvement in contour. Waldorf et al<sup>5</sup> noted that the intense erythema present during the early phases of healing after laser resurfacing is accompanied by edema that effaces residual rhytides. In their study, there was less improvement at 3 months compared with 4 weeks. Collagen remodeling and wound contraction is believed to continue for at least 1 year with both resurfacing methods. Ross et al<sup>13</sup> showed a trend toward improvement in wrinkles between 2 months and 1 year after laser resurfacing; however, the improvement was not statistically significant. Manuskiatti et al<sup>14</sup> found comparable improvement in wrinkles 3 months and 2 years after laser resurfacing. There was a trend toward increased wrinkling between postoperative month 3 and year 2. Approximately 96% of the original wrinkle score reduction was present in the perioral area (85% for the periorbital area) after 2 years.

Similar long-term changes in dermal collagen are known to occur with dermabrasion, laser resurfacing, and

medium-depth and deep chemical peel methods.<sup>14-18</sup> Dense new collagen bundles, arranged parallel to the epidermis, appear just beneath the dermal-epidermal junction. This new collagen is deposited superficially to collagen with evidence of solar elastosis. Manuskiatti et al<sup>14</sup> demonstrated increasing thickness of this zone of new collagen between postoperative months 3 and 24 after laser resurfacing. Similarly, Benedetto et al<sup>15</sup> demonstrated persistence of this distinct zone of horizontally arranged new collagen up to 8 years after dermabrasion. In another study,<sup>19</sup> a 270% increase in dermal procollagen was demonstrated 12 weeks after dermabrasion.

Perhaps the most important figure in our study is the percentage of cases in which the laser-treated side was judged to be more improved. In 43% of cases (n=6), the blinded observers preferred the laser-treated side; the dermabrasion-treated side was preferred in only 7% of cases (n=1); and in 50% of cases (n=7), no difference was appreciated between the 2 sides. Although there was a trend toward greater improvement in rhytide scores with the carbon dioxide laser treatment, the difference in scores for the 2 methods was not significant at 4 months ( $P=.35$ ). With our scoring system based on 5 standardized photographs we observed excellent blinded interobserver agreement. With more detailed grading scales interobserver agreement diminished. Direct observation of the perioral area also led to greater interobserver agreement than scoring based on photographs. We used only the former in our study. Some of the more subtle differences in skin treated with the 2 methods are difficult to appreciate in photographs. Bright lighting and the availability of a tangential lighting source enhanced evaluation. Completely objective and precise measurements are difficult to obtain in any type of clinical outcome study involving resurfacing treatments. Prior to a previous study at our institution, several of the individuals involved in this study experimented with the use of replicas consisting of dental impression material for measuring the volume and depth of rhytides. The replicas proved difficult to use. Ross et al<sup>13</sup> found good correlation between replicas and clinical photographs in their study.

The disadvantages of the dermabrasion method are often cited as reasons for selecting the carbon dioxide laser as the resurfacing method. Disadvantages include the technical difficulty of the procedure and potential exposure to aerosolized blood-borne pathogens.<sup>20-22</sup> When dermabrasion is performed with a wire brush or fraise, injury can result from spinning equipment catching on loose skin or gauze.<sup>20</sup> Gouging is more likely on surfaces with acute curvatures. The procedure is difficult to perform on periorbital skin. Dermabrasion with the wire brush requires the use of a cryogenic spray to stabilize the tissue for planing. If used improperly, the spray can produce hypothermic injury, resulting in hypertrophic scarring.<sup>20,21</sup> Other risks associated with dermabrasion can occur with any resurfacing method, including the carbon dioxide laser. These risks include postoperative infections, scarring, hyperpigmentation, hypopigmentation, milia formation, and acne flares.

It should be noted that even with laser resurfacing there is a theoretical risk of exposure to infectious agents in the vapor produced by the instrument.<sup>23</sup> The air-

borne particles that are produced are small enough to pass through surgical masks. For example, one group of investigators demonstrated intact papillomavirus DNA in the laser plume produced during the treatment of verrucae.<sup>24</sup> Regardless of the method used, protective gear and equipment are essential.

Recently, there has been renewed interest in manual dermabrasion (also known as *dermasanding*).<sup>4,25,26</sup> This technique offers several advantages relative to dermabrasion with the wire brush or fraise. Potentially infectious aerosolized particles and splatter are less likely to be produced. The chance of injury resulting from rapidly spinning equipment catching on gauze or loose skin is small. Cost of supplies is minimal, and there is no equipment to maintain. Depth of tissue removal is easily controlled, and the technique does not tend to produce sharp lines of demarcation. Sandpaper and sanding screens of varying grades are available, and less experienced surgeons can use finer grades when first learning the technique. There are a few disadvantages relative to dermabrasion with the fraise or wire brush. The manual technique is more time-consuming but not more so than laser resurfacing with the procedure we describe herein. We found the sanding screen to be more difficult to use on surfaces with grooves and concavities. In contrast, fraises are available in a variety of shapes to deal with such variations in surface contour. Care must be taken to avoid unintentional tissue injury with the sharp edges of the sanding screen. Wrapping the cut edges of the screen around the end of a sterile 3-mL syringe used as a support or sanding block can help to avoid injury.

Manual dermabrasion has been used successfully in combination with low-strength trichloroacetic acid peeling<sup>26</sup> and with tumescent anesthesia and cryospraying for the treatment of actinically damaged skin.<sup>25</sup> The latter combination offers the advantage of greater hemostasis. Although we used a sanding screen (mesh covered with abrasive particles) in our study, others have advocated the use of various types of sandpaper.<sup>25,26</sup> Sandpaper, especially the finer grades, bends more easily than the mesh and can be somewhat easier to handle. Gross<sup>27</sup> describes the use of fraises attached to a special handle held like a scalpel. This type of device allows for manual dermabrasion in hard-to-reach places where sandpaper would be more difficult to use. Fraises from the Dremel rotary tool<sup>25</sup> and the abrasive pads used to remove char from electrosurgical instrument heads<sup>28</sup> have also been used for dermabrasion. Clearly, manual dermabrasion is a technique with many potential modifications and advantages. In our study, we did not appreciate any differences in outcome or complications between the 2 methods of dermabrasion used.

In a study similar to ours, Gin et al<sup>2</sup> compared a carbon dioxide laser with a 950-millisecond dwell time with manual tumescent dermabrasion with handle-mounted diamond fraises for the treatment of upper-lip wrinkles. The 2 techniques proved equally effective for the treatment of wrinkles in this anatomic location. Although the carbon dioxide laser and the dermabrasion techniques used in our study were slightly different, we reached the same conclusion. It should be noted that these results might be site specific. One cannot conclude that other areas of the face will respond in the same manner.

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