Our Approach to Non-Ablative Treatment Of Photoaging

Robert A. Weiss, MD,* Margaret A. Weiss, MD, Karen L. Beasley, MD, and Girish Munavalli, MD
Department of Dermatology, Johns Hopkins U School of Medicine, Director, MD Laser Skin and Vein Institute, 54 Scott Adam Road, Baltimore, Maryland 21030

Background and Objectives: Many laser, light and energy emitting devices are utilized for skin rejuvenation.

Study Design/Materials and Methods: The clinical approach to multiple problems of photoaging are discussed and an algorithm for approach by problem is presented.

Results: Clinical use of various modalities such as LED photomodulation, intense pulsed light, pulsed dye laser, KTP laser, radiofrequency and fractional resurfacing are presented with successful parameters, developed over several years, utilized on a daily basis in a busy cosmetic dermatology clinic.


© 2005 Wiley-Liss, Inc.

Key words: mottled pigmentation; photoaging; sagging; telangiectasias; wrinkling

INTRODUCTION

As 10,000 to 15,000 baby boomers turn 50 each day, some frequently ask how to reverse the appearance of facial aging. Numerous times per day, the providers in our practice try to answer this important question. We try to take a consistent approach from one to another, as our staff who assists us must be able to provide educational, informational, and cost information on commonly performed laser and light source treatments, as well as supplemental techniques such as microdermabrasion. We can be consistent as our extensive long-term experience with specific treatments such as intense pulsed light for photoaging gives us a strong foundation [1].

Typically, we schedule 20 minutes for our physician consultations; patients usually have additional questions, which an assistant then helps to answer. This staff person assigned to the physician provides information and descriptive pamphlets as necessary, so that the patient can learn more about the recommended treatments. They may direct the patient to various websites including our own as well as educational, informative, and cost information on commonly performed laser and light source treatments, as well as supplemental techniques such as microdermabrasion. We can be consistent as our extensive long-term experience with specific treatments such as intense pulsed light for photoaging gives us a strong foundation [1].

While the new patient is evaluating our practice as to the knowledge, integrity, and competence of our physicians and staff, at the same time we are trying to evaluate the expectations, integrity, and idiosyncrasies of the potential patient. If our staff notes any unusually hostile tone or special demands from the patient during the appointment making process on the phone, this is noted in an HIPAA compliant computerized appointment book. Any new patient has no chart at that point—no binding interaction has occurred, and in rare instances we have declined to schedule such patients.

As the patient is brought back from the waiting room, our staff notes any derogatory or positive comments about check-in, state of the office, or waiting time. They alert the physician of a valid concern. If a patient characterizes a 15 minutes wait as “too long,” this type of comment is noted in the chart using an internal symbol code. Once the patient is escorted to the examination room, the certified medical assistant (CMA) takes a brief history. The CMA then relates the complaints or needs of the patient to the physician and escorts the physician into the room so that there is always a chaperone present.

Normally patients are friendly when the physician enters the examination room; the rare hostile response to the physician or an unusual degree of anxiety is noted. We ask the patient to briefly state their complaint in their own words. As our next step, we give patients a mirror and ask them to point out specific areas of their face that they perceive as a problem. At this point, we are trying to ascertain whether it is textural roughness, telangiectasia, mottled pigmentation, wrinkles, sagging, or acne scarring which are the primary, secondary, or tertiary concerns. We try to elicit the order of priority, which allows us the handle even a “shopping list” of problems.

Occasionally patients respond to the mirror placed in front of them, “you tell me, you are the doctor!” We are unlikely to recommend any procedure for those patients because if they cannot perceive the specific components of aging, then they will never notice when specific components

*Correspondence to: Robert A. Weiss, MD, Associate Prof., Department of Dermatology, Johns Hopkins U School of Medicine, Director, MD Laser Skin and Vein Institute, 54 Scott Adam Road Baltimore, MD 21030.
E-mail: rweiss@mdlaserskinvein.com; www.smoothskin.net
R.A.W. has disclosed a potential financial conflict of interest with this study.
Accepted 11 May 2005
Published online 18 July 2005 in Wiley InterScience (www.interscience.wiley.com).
DOI 10.1002/lsm.20199

© 2005 Wiley-Liss, Inc.
are improved. These patients are trying to shift all responsibility away from them and back onto the healthcare provider and are unlikely to ever be satisfied with their treatment.

Other patient questions that usually lead us to not treat them are relatively rare—“Are you qualified to perform this?” or “Have you ever been sued for this procedure?” We reject this type of patient, recommending that they do further research and then return when they have more confidence and/or information about the practice, techniques, and physician. We explain that the Internet has a lot of information about procedures, practices, and physicians as well as advice in seeking a physician. We comment that an analogous situation would be at a job interview in which the prospective employee was asked, “Have you ever been fired for incompetence?” This would most likely result in the end of the interview. Confrontational questions are not the foundation for a good relationship between patient and physician. The patient’s trust is essential for any cosmetic treatment to be perceived as successful. Even a visual improvement will be viewed as a treatment failure without a high-quality physician patient relationship.

The algorithm shown in Table 1 is the treatment plan that we typically outline for new patients. Specific problems are discussed below using the algorithm as detailed by component of photoaging. We inform patients that the tradeoff for less downtime is more treatment sessions. More aggressive device settings can be pursued with fewer total treatments but this will result in possibly more downtime and side effects such as edema, erythema, purpura, and crusting of pigmented regions.

TELANGIECTASIAS

Many Caucasian patients have telangiectasias as the primary component of photoaging (Fig. 1). If these are

TABLE 1. Problem-Oriented Treatment Algorithm for Photoaging

<table>
<thead>
<tr>
<th>Component</th>
<th>Treatment Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telangiectasias</td>
<td>IPL, PDL (extended pulse), large spot size 532 nm</td>
</tr>
<tr>
<td>Mottled pigmentation</td>
<td>IPL, large spot size 532 nm</td>
</tr>
<tr>
<td>Microdermabrasion adjunctive Q-switched alexandrite or ruby as adjunctive for resistant areas</td>
<td></td>
</tr>
<tr>
<td>Mild rhytides</td>
<td>IPL, 1,320, 1,450 nm, micro-ablative fractional resurfacing</td>
</tr>
<tr>
<td>Moderate rhytides</td>
<td>Micro-ablative fractional, 1,320, 1,450 nm, monopolar RF, Nd:YAG 1064 nm</td>
</tr>
<tr>
<td>Acne Scares</td>
<td>Non-erythematos–microablative fractional resurfacing, 1,320, 1,450 nm ± Microdermabrasion</td>
</tr>
<tr>
<td>Erythematos–IPL, PDL</td>
<td></td>
</tr>
<tr>
<td>Sagging</td>
<td>Monopolar RF</td>
</tr>
<tr>
<td>Surface textural smoothing</td>
<td>All of the above, LED photomodulation</td>
</tr>
<tr>
<td>Appropriate topical anti-oxidants</td>
<td>as retinoids, ascorbic acid, or polyphenols to enhance and maintain</td>
</tr>
</tbody>
</table>

accompanied by other manifestations such as mottled pigmentation, as is typically the case, we recommend a technique that is most likely to treat all the components of the problem. In our practice, we initially suggest intense pulsed light (IPL) for Fitzpatrick skin types I–III. The reason is the success we have had as well as the extensive experience we have accumulated since the earlier developmental stages of the technique in 1995. The parameters we use are the best in our experience for a particular device. For example, we have had experience with thousands of treatment sessions since the development of the Lumenis Quantum SR (Lumenis, Santa Clara, CA). It is used at a double pulse with a 560 nm filter with a very thin layer of gel to allow the chilled crystal to reduce surface temperature. The pulse durations are 2.4 and 6 milliseconds with a 10 milliseconds delay between the pulses for a total pulse time of 18.4 milliseconds and a total fluence of 25–28 J/cm².

Fig. 1. A: Telangiectasias seen in a fair skinned patient resulting from genetically susceptibility combined with ultraviolet exposure. B: After one treatment with IPL seen just before the second treatment. Device used was Quantum™ (Lumenis, Santa Clara, CA) with settings of 2.4 milliseconds, 10 milliseconds delay, and 6 milliseconds second pulse with 28 J/cm², chilled crystal, 560 nm filter.
Most recently, we have also added the Palomar Starlux (Palomar, Burlington, MA) used with the “G” handpiece at a 20 milliseconds pulse duration with energy of 36–40 J/cm² as an alternative.

There are some patients who are unresponsive or have curved topography along the nasal alae, which can be difficult to treat with large crystals of IPL. Some patients may find IPL too painful or there are multiple fine red telangiectasias less than 0.3 mm in diameter, not responding to IPL. For these patients, we use the extended pulse dye laser (PDL) as an alternative. We typically use the Cynosure V-Star (Cynosure, Chelmsford, MA) with the Zimmer air cooler set at 1. Typically starting settings are 10 milliseconds duration, 10 mm spot, 7.5 J/cm². Treatment consists of a 50% overlap or double pulsing as necessary to observe a visible photodarkening. We hardly ever reduce the pulse duration to 6 milliseconds as this would increase risk of purpura; however, some patients will on rare occasions require shorter pulse durations with accompanying purpura to induce clearing of vessels less than 0.3–0.2 mm in diameter.

The newest device that we have added to the possible initial treatments for the telangiectatic component of photoaging is the Gemini (Laserscope, San Jose, CA), which features a 10 mm spot size of 532 nm KTP. This is now recommended for patients with the most severe photodamage who want fast results. As 532 nm is absorbed most intensely by hemoglobin and melanin, we believe that fewer treatments are necessary for these components of photoaging (Fig. 2). The patients are informed that there is a higher risk for edema lasting up to 3 days and erythema lasting for 24 hours, but the tradeoff for fewer treatments is one that some patients are willing to accept.

**MOTTLED PIGMENTATION**

Our approach is very similar to that for telangiectasias as these two components of photaging often coexist. However in patients for whom mottled pigmentation is the predominant component we are more likely to use microdermabrasion as an adjunctive procedure. This is mainly to enhance the penetration of topical hydroquinones and sunscreens, which are essential for success longer term, especially in regions of the world where the sun is always intense. We may also change the settings of the various devices utilized. This includes changing the Quantum to a shorter pulse duration cycle of 2.4 and 4 milliseconds with a 10 milliseconds delay for a total duration of 16.4 milliseconds typically at a fluence of 25–28 J/cm². Our clinical experience has been that shorter pulse durations as well as lower cut-off filters with IPL improve the response to pigmentation. The lower cut-off filters of the V handpiece of the Starlux with lower emitted wavelengths are used for residual pigmentation. We prefer not to use extended PDL lasers as the efficacy is less compared to devices with lower wavelengths more highly absorbed by melanin. We are more likely to suggest large spot size 532 nm for patients with considerable mottled pigmentation photoaging component as melanin would effectively absorb 532 nm more effectively (Fig. 3). If persistent pigmented spots remain following full face IPL or 532 nm treatment, we may follow-up with more intense treatment using higher fluences, lower cut-off filters and less skin surface cooling. Alternatively, Q-switched alexandrite (755 nm) or Q-Switched ruby (694 nm) lasers can be used for spot treatment during the photorejuvenation process.

**MILD RHYTIDES**

Although there is some response with the devices utilized for the first two components, it is often necessary to employ an additional treatment modality such as a water-only absorbing laser to treat fine rhytides (Fig. 4). This type of laser heats up water molecules around collagen, causing a very controlled wound healing response [2]. The devices used for this include the 1,320 nm CoolTouch 3 (Cool Touch3, CoolTouch Corp, Roseville, CA) with fluence of

---

Fig. 2. Before and 4 weeks after treatment with large spot (10 mm) 532 nm KTP laser (Gemini, Laserscope, San Jose, CA). Reduction in pigmentation and erythema is seen. Settings were 8 J/cm², 10 mm spot, 22 milliseconds pulse duration. Two passes were performed.

Fig. 3. Pigmentation before and at 7 days post-treatment with large spot (10 mm) 532 nm KTP laser. Settings were 9 J/cm², 10 mm spot, 22 milliseconds pulse duration. Three passes were performed. Some residual crusting of pigmentation can be seen.
17–19 J/cm², with the latest iteration allowing for pre, mid, and post laser pulse cooling. Pulse duration is fixed at 50 milliseconds so cooling and fluence are the primary treatment parameters modified. Our preferred settings for collagen contraction are 10 milliseconds pre-cooling, 5 milliseconds mid, and 10 milliseconds post for a total of 25 milliseconds of cooling. We no longer monitor skin temperature at the conclusion of a pulse but allow the device to cut off when skin temperature has reached 40°C. A typical treatment now involves two to three passes. As skin temperature rises, the pain of treatment increases. The vast majority of patients elect to have a topical anesthetic such as L.M.X.4® Cream 4% topical lidocaine (Ferndale Laboratories, Ferndale, MI) applied 45 minutes in advance of the procedure. Such topical anesthetic is rarely used for IPL, extended PDL, or large spot 532 nm.

For patients with thinner skin, we find that the use of a less penetrating wavelength (more highly absorbed by water) may yield better results. For those patients, we use the 1,450 nm Smoothbeam (Candela, Wayland, MA) with typical settings of 11–12 J/cm², fixed pulse duration, 35–40 milliseconds of cryogen spray and a 6 mm spot size. Two to three passes are the norm.

The use of spot or microablative, fractional resurfacing (Fraxel™, Reliant Technology, San Diego, CA) utilizing 70–100 μm diameter ablation points with a 1,550 nm wavelength is presently under study. We have had some initial success with mild rhytids around the eyes. Compared to 1,320 and 1,450 nm patients will trade more down time with fractional resurfacing in exchange for more improvement. Whether this modality will replace the 1,320 and 1,450 nm for acne scars and wrinkling is being investigated at this time.

MODERATE RHYTIDES

The treatment of moderate rhytids (Fig. 5) is probably the most controversial and leads to the most passionate discussions. Many devices are now available for this application. We are also evolving better non-ablative approaches within our practice. The problem of moderate rhytids may also be accompanied by significant sagging, which can
make both treatment and response more difficult. Our approach at this time is to treat with 1,320 nm, three passes as described above. Often 1,450 nm is utilized as an additional pass. We have the least success with this indication and even less success for upper lip moderate rhytides, which often require ablative resurfacing.

Our experience with monopolar RF (Thermacool TC, Thermage, Haywood, CA) with multiple passes using lower fluence has been positive over the past several years, especially for naso-labial folds, sagging cheek fat pads and sagging of the submental region similar to what has been previously reported [3]. This is being examined with a carefully controlled study using 300–400 pulses, the 1.5 cm² tip with settings of 61.5–63. Initial results appear promising (Fig. 6).

We are exploring the use of microablative fractional resurfacing for the moderate perioral rhytids. Although resounding success has eluded us at this point, treatment parameters are being re-evaluated. It may require higher fluence with less density of microablative zones. This may eventually replace our approach of 1,320 and/or 1,450 nm, which has been our standard for several years now.

Some laser practitioners claim that use of 1,064 nm Nd:YAG may have the best effect of all laser wavelengths as it has the deepest penetration. Although our experience has not been overwhelmingly positive, we plan to give this wavelength further study over the coming year at pulse durations over 50 milliseconds.

**ACNE SCARS**

Acne scars represent a special subset of patients with photoaging (Fig. 7). Patients come to our practice as their

---

Fig. 6. Submental and cheek pad sagging treated with the multiple passes, lower fluence algorithm for monopolar RF (Thermacool TC™, Thermage, San Jose, CA). (A) Before (B) 2 months post 400 pulses using the 1.5 cm² tip at settings of 61.5–63. Tightening of the submentum is clearly visible.

Fig. 7. A: Untreated acne scarring made worse by skin sagging in a middle-aged male. B: Acne scarring in a patient of Asian descent. C: Results after three treatments with dermal heating resulting from 1,320 nm (Cooltouch, Cooltouch Corp, Roseville, CA). Treatment settings were 18 J/cm² with 20 milliseconds pre-cooling and 10 milliseconds post-cooling with dynamic spray cooling.
face begins to sag from gravity and photoaging effects; the scars become much more noticeable particularly on the lower cheeks and chin. The approach to this problem remains the same as for collagen remodeling in rhytids using water absorbed wavelengths to heat collagen. The problem resides in the original depth of collagen injury causing the scarring. In other words it is possible that the wavelength utilized is not heating at the correct depth for a specific location or scar. We typically anticipate heating the skin down to a depth of 400 µm with 1,320 nm and down to 200 µm with 1,450 nm. While we can get positive responses in about four of five patients, 30%–50% improvement is usually observed. As long as patient’s understand these statistics and are willing to accept this outcome, patients are typically satisfied with the results, except for the 20% from whom we cannot elicit a noticeable response. As a general rule, it is best to set patient expectations to the minimal results for a device.

In patients with acne scars, we are now trying fractional resurfacing with some initial positive responses. Again, the evaluation process is early and ongoing so it is not possible to know yet whether this will become the standard for acne scars. For new erythematous scars in younger patients with active acne we prefer the methods described for erythematous lesions and typically use extended PDL. Some initial responses with erythematous acne scars and active acne with the 532 nm large spot size are also encouraging.

SAGGING

Only a deeply penetrating method of heating the dermis and possibly the fibrous septae supporting the dermis and subcutaneous fat to the underlying fascia could possibly have an effect (Fig. 6). We have had the most success with the monopolar RF method (Thermacool TC, Thermage, Haywood, CA) and now have experience with close to 500 patients. This is our standard for those patients not requiring or desiring a facelift. Typical parameters are the same as mentioned before with lower energies and multiple passes, utilizing from 600 to 900 pulses depending on the areas treated and the degree of sagging. Treatments often approach 1 hour but downtime is minimal with erythema for up to 4 hours and occasional edema up to 48 hours.

SURFACE TEXTURAL SMOOTHING

Textural roughness is a problem that seems to be aided by almost every device listed. These results, in our opinion, are from the thermal energy applied and the papillary dermal capillary leakage and subsequent inflammatory and cytokine pathways activated. This effect is seen most dramatically in photographic images in which the skin takes on a more flash reflective appearance (Figs. 8 and 9). One of the newest concepts in acquiring this smoother appearance of the epidermis and related to stimulating very superficial collagen production in a non-thermal way is LED photomodulation (Gentlewaves™, LightBioScience, Virginia Beach, VA). The initial clinical trial with this device has been previously described [4]. We also use LED photomodulation to enhance the results from all the other techniques (Fig. 9). Our clinical experience is that photomodulation can also help to reduce erythema from IPL, PDL, 532, 1,320, and 1,450 nm. We routinely treat all patients immediately post these treatment modalities with the non-thermal LED device.

TOPICALS

Although this is appropriate to mention, the wide range of cosmeceuticals available either by prescription or OTC is beyond the scope of this discussion. We encourage the use of topical anti-oxidants such as retinoids, ascorbic acid, or polyphenols to enhance and maintain the results of photorejuvenation. Growth factors topically seem to be
playing an increasingly important role. No patient walks out of our office without a sample of sunscreen particularly because they have invested in improving their skin. The ongoing daily use of sunscreen is probably the most agreed-upon recommendation for improving and maintaining improvement of photoaging.

CONCLUSION

Many patients today seek the least invasive treatments possible for improving their photoaging. The components of photoaging can be treated with great success with the algorithm discussed here. While not all patients will respond, and results vary, most patients with realistic expectations will do well. A professional, honest, and friendly interaction between physician and patient greatly improves the possibility for recognized positive outcomes.

REFERENCES