Integrating Energy Based Devices for Medical Applications

An experienced specialist highlights the top five medical conditions where energy based devices play a role.

By Vic A. Narurkar, MD

Many “medical” conditions in dermatology have associated appearance related issues that are perceived as “aesthetic.” This is particularly evident in cutaneous conditions requiring the use of energy based devices such as lasers, light and radiofrequency. As practicing dermatologists, it is imperative to understand when and how these devices should be utilized in the spectrum of cutaneous conditions. This inaugural column will review the most common “medical” conditions where the use of energy based devices is appropriate. In the practice of dermatology, combination therapy is the mainstay of most therapies, including combining topical and oral agents—one must think of the use of energy based devices in this continuum.

The top five medical conditions where devices play a role include acne (active and dormant), rosacea, melasma, surgical and traumatic scars, and actinically induced photodamage (Table 1). For some of these conditions, energy based devices are the only alternative to address a component of the condition (e.g., residual telangiectasias of rosacea), while in others, energy based devices may offer a more predictable and safer alternative to traditional therapies (e.g., scars, actinic keratoses) (Table 2). It is imperative to understand when and how to integrate devices to achieve the best treatment outcomes.

Rosacea

The use of visible light and laser sources is now considered essential for the treatment of facial telangiectasias, regardless of the cause. Medical therapy of rosacea can control outbreaks but has a limited role in the treatment of telangiectasias. Conversely, if laser and light alone are utilized to treat rosacea, treatment is generally disappointing, as the devices are treating in a “static” phase, whereas rosacea is an active condition. Our approach to the treatment of rosacea is to first manage it medically, and we will never initiate treatment with energy based devices for the first six to eight weeks. Examples of devices that are effective in the management of telangiectasias associated with rosacea include the 585nm flashlamp pumped pulsed dye laser, the 595nm flashlamp pumped pulsed dye laser and intense pulsed light sources (Fig. 1). The “flush” and background erythema of rosacea pose challenges and it is our experience that while combination therapies may control it, it is never truly eradicated. We also stress maintenance of telangiectasias...
treatment, usually once every six months after the initial series is completed.

**Surgical and Traumatic Scars**

Another area in which energy based devices are rapidly gaining acceptance over traditional therapies is the treatment of scars, whether induced surgically or by trauma. Scars are complex and can be divided into atrophic, flat and hypertrophic, as well as erythematous, hypopigmented and hyperpigmented. Often, scars will exhibit multiple features. Traditional therapy of scars includes intralesional injection of corticosteroids for hypertrophic scars, dermabrasion and dermasanding for hypertrophic and atrophic scars, and bleaching agents for hyperpigmented scars. While these treatments may be effective, energy based devices achieve more predictable outcomes, as depth and energy can be better controlled than with mechanical measures. Erythematous scars are best treated with 585 and 595nm pulsed dye lasers, 532nm KTP lasers, and intense pulsed light. Hypertrophic scars are best treated with non-ablative fractional laser resurfacing or ablative fractional resurfacing, followed by pulsed dye lasers. Atrophic scars are best treated with non-ablative fractional resurfacing. Hyperpigmented scars are best treated with non-ablative fractional resurfacing. For scars exhibiting multimodal aspects, our approach is to first start with non-ablative fractional resurfacing, as this addresses the largest components of scars, and then follow with other energy based devices if necessary. Combination therapies with intrallesional corticosteroids and energy based devices can also be used, especially in very thick scars. (Fig. 2)

**Actinically Induced Photodamage**

The mainstay of medical therapies for extensive actinic keratoses has been the use of topical chemotherapeutic agents, chemical peels, and dermabrasion. The use of energy based devices is gradually transforming this landscape, especially when there is an added benefit of the “general” appearance of the skin following laser resurfacing or photodynamic therapy. The original rationale for the development of traditional ablative laser resurfacing was the treatment of actinic keratoses and it rapidly changed from that indication to a more “cosmetic” nature. While ablative laser resurfacing is highly effective for the treatment of extensive actinic damage, it poses risks of hypopigmentation, persistent erythema and scarring, especially off-face. The mainstay of energy based devices for actinic damage now includes photodynamic therapy and fractional laser resurfacing, both ablative and non-ablative.

Short contact photodynamic therapy is an excellent treatment for flat actinic keratoses and can also achieve simultaneous improvement of dyschromia and telangiectasias. The most widely used photosensitizer is 5-amino levulanic acid, which can be activated

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**Table 1. Top Five Medical Conditions for Energy Based Devices**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Devices</th>
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<tbody>
<tr>
<td>Rosacea (facial telangiectasias)</td>
<td>532nm KTP laser; 585nm and 595nm PDL; intense pulsed light</td>
</tr>
<tr>
<td>Scars (surgical &amp; traumatic)</td>
<td>585nm and 595nm PDL; intense pulsed light; 1440nm, 1540 and 1550 nm NFR; 2940nm and 10,600nm AFR</td>
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<tr>
<td>Actinic damage</td>
<td>PDT with 420nm light, PDL, IPL; 1440, 1540, 1550 and 1927 nm NFR; 2790, 2940, 10,600nm AFR</td>
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<tr>
<td>Melasma</td>
<td>Intense pulsed light, Q5 755nm (superficial); 1440, 1540 and 1550nm NFR</td>
</tr>
<tr>
<td>Acne vulgaris (active disease)</td>
<td>420nm light; photopneumatic therapy; 532nm, 585nm and 595nm lasers, intense pulsed light, 1450nm laser; unipolar radiofrequency</td>
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</tbody>
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**Table 2. Medical Conditions and Their Response to Energy Based Devices as Monotherapy**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Component</th>
<th>Response To Energy Based Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rosacea</td>
<td>Telangiectasias</td>
<td>++++</td>
</tr>
<tr>
<td>Scars</td>
<td>Texture and color</td>
<td>++++</td>
</tr>
<tr>
<td>Actinic damage</td>
<td>Flat AKs and dyschromia</td>
<td>+++</td>
</tr>
<tr>
<td>Acne vulgaris</td>
<td>Active acne</td>
<td>++</td>
</tr>
<tr>
<td>Melasma</td>
<td>Pigmentation</td>
<td>++</td>
</tr>
</tbody>
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by a variety of laser and light sources including 420nm blue light, 58 nm and 595nm flash lamp pumped dye lasers, 532nm KTP lasers, and intense pulsed light. Often combining a visible light source along with 420nm light leads to better cosmetic outcomes. Fractional laser resurfacing also offers an effective treatment of actinic keratoses with simultaneous cosmetic outcomes. For facial photodamage, ablative fractional resurfacing with 2790nm, 2940nm and 10,600nm lasers requires fewer treatments, while non-ablative fractional resurfacing with the 1440nm, 1540 and 1550nm lasers can be used both on- and off-face but will require additional treatments. Recently, a non-ablative 1927nm fractional laser was introduced to enhance efficacy for the treatment of actinic keratoses. The advantage of fractional resurfacing over photodynamic therapy is greater predictability in outcomes, as there is still a wide range in activation of 5-aminolevulanic acid.

**Acne Vulgaris**

One of the greatest controversies in energy based devices in medical treatment is the treatment of acne vulgaris. Over enthusiasm to utilize energy based devices as monotherapy for acne will produce disappointing results. It is best to think of acne as a spectrum—and at any given instance, a myriad of features are seen in the acne patient: active lesions, dormant lesions, and scars. With the exception of oral retinoids, there is yet to be defined a true “long-term” management of acne without any adjuvant therapies. And even with oral retinoids, there are treatment failures. The role for energy based devices in acne should be introduced in a systematic fashion in order to achieve efficacy.

We have designed an algorithm for how to integrate energy based devices in the treatment of acne vulgaris. The mainstay of “management” of acne remains the use of topical agents and oral antibiotics. There are numerous instances when these options are not applicable, such as women who are trying to get pregnant, women who are pregnant, women who are nursing, and patients who have exhausted the spectrum of traditional acne therapies.

![Fig. 2. Pre- and Post-Mohs Surgery scar treated with combination intralesional steroids and one 10,600nm AFR treatment.](image)

![Fig. 3. Combination Therapies: Pre, Post PDT and photopneumatic therapy and post 1550nm NFR.](image)
therapies and are not willing to take oral retinoids. This subgroup of patients is ideal to consider energy based devices. We generally don’t treat pregnant patients with energy based devices unless the acne is exceedingly severe. Acne devices can be divided into those that target P. acnes bacteria (420nm blue light), sebaceous glands (1450nm laser, unipolar radiofrequency), and combined targets (photopneumatic therapy). Visible light and near infra-red lasers can also be utilized to treat acne, although the target is unclear, and it may be primarily some random heating as well as improvement of erythema associated with acne which may produce an improvement in the appearance. Photodynamic therapy for acne uses 5-amino levulannic acid with a variety of laser and light sources, and is utilized for more severe cases of acne which do not respond to devices alone.

Since acne is a continuum of disease, patients often desire treatment of post inflammatory hyperpigmentation associated with acne, erythematous scars, and generalized acne scars (pits, boxcar, atrophic, hypertrophic). It is imperative to educate the patient that any “revisional treatment” of acne scars without controlling acne may be frustrating. However, energy based devices often can do both—especially improve some of the dyschromias and erythema. For definitive treatment of acne scarring, non-ablative and ablative fractional laser resurfacing is optimal but should only be performed after the acne is under control. If the patient underwent treatment with oral retinoids, we wait six months to one year before initiating any corrective laser therapy.

Melasma
The least predictable medical condition with energy based devices is melasma. As with acne, melasma is a “fluid” condition. The mainstay of managing melasma is the use of hydroquinones and retinoids topically. A variety of other bleaching agents have been tried with limited success. Traditional “corrective” modes of melasma have included the use of chemical peels, such as the Jessners peel, and these still play an active role. We utilize lasers only for therapy-resistant melasma and never treat melasma with lasers without adequate pre- and post-treatment. Moreover, melasma shows a high rate of recurrence, and it is imperative to discuss this with the patient. Even with these limitations, great strides have been made with the advent of lasers. Superficial melasma may respond to Q-switched alexandrite lasers and intense pulsed light. Mixed melasma and purely dermal melasma is the most difficult to treat and non-ablative fractional laser resurfacing is the only modality that has shown consistent success.

Combination Therapies
It is increasingly evident that combination therapy is the dogma of dermatology. We perform it routinely, whether we are practicing medical dermatology or aesthetic dermatology. Energy based devices do best when used in combination with medical therapies, but there is a specific term we use: “sequential” combination therapies. This is best described for medical conditions that can manifest with a variety of symptoms. An example is shown in Fig. 3. The patient presented with therapy-resistant rosacea with a component of acne and was initially managed with topical agents and oral antibiotics. When this failed, photodynamic therapy with Levulan was performed using a photopneumatic energy based device. This produced improvement of his rosacea and acne, but he was then left with some rhinophyma and scarring which was then treated with non-ablative fractional laser resurfacing.

Conclusions
As dermatologists, we sometimes separate ourselves as “medical” versus “surgical” versus “aesthetic.” The reality is, whatever path our primary practice may take, it is important to remember that the practice of dermatology encompasses all three facets. Energy based devices are a perfect example of this diaspora. By understanding how and when to utilize lasers, light and radiofrequency devices, we can improve on the outcomes of “medical” and “surgical” dermatology and achieve an optimal “aesthetic” result.

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