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Seminars in Cutaneous Medicine and Surgery

Current and Future Trends in Home Laser Devices

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Laser and intense pulse light procedures, once limited to physician offices and operating rooms, have become increasingly available at a variety of nonmedical sites such as spas. State regulations as to whom can perform these treatments varies greatly across the United States and, thus, in some states, the operators of these devices do not have any significant additional medical or laser knowledge more so than the patients who receive treatment. Although serious complications of laser treatments occur, they are rare when the procedure is performed correctly. Currently, there are 2 light devices approved by the Food and Drug Administration for home hair removal on the U.S. market, and several other companies are expected to release products in the near future. There are two home laser devices marketed for hair loss. As these light-based devices become smaller, safer, easier to use, as well as cheaper to manufacture, direct use by patients will increase. Results from home use devices are impressive but still inferior to office-based lasers and light devices. It is likely that home lasers and intense pulsed light devices will eventually receive other indications because many of these devices use wavelengths similar to currently available office based equipment.
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Out of all cosmetic laser procedures performed in an office setting, laser hair removal is likely the one that has been delegated to more nonphysicians than any other procedure. This move is likely in part the result of the commonly held, although not proven belief that laser hair removal requires less expertise to correctly perform. Although laser hair removal is performed by physicians in the clinics I staff, it is hard to deny that the overall trend in the industry has been to delegate this task to nonphysicians. The time is now at hand that, if desired, the responsibility for certain light-based treatments can be further delegated to patients themselves, who can now perform these procedures in the comfort of their own homes. In this article on home-based light devices, I will focus on the currently available laser and intense pulse light devices that are presently intended for hair removal as well as discuss potential risks and future additional indications for home-based lasers and intense pulse light sources.

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Research on the development of a self use laser device for the treatment of PFB (pseudofolliculitis barbae) was through a congressional funded study by the Department of Defense. Palomar Medical was awarded this contract. The author does not have any financial association with Palomar Medical.

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In 2007, 11.7 million cosmetic surgical and nonsurgical procedures were performed in the United States, with laser hair removal being the third most common nonsurgical procedure, accounting for 1,412,657 visits. Women accounted for 87% of these hair removal procedures, with laser hair removal being the most common nonsurgical cosmetic procedure for individuals between the ages of 19 and 34 years.[1] The hair removal industry is approximately 10 billion dollars annually, and many companies are eager to tap into this market with new and exciting products. During the last decade, office-based laser devices have become more powerful with higher fluences, larger spot sizes, faster repetition rates, and improved epidermal cooling. Office-based laser hair removal devices of multiple different wave lengths exist with the most common being the 755-nm alexandrite, 800- to 810-nm diode, and 1064-nm Nd:YAG devices. Next-generation office-based intense pulse light devices with improved epidermal cooling and filtering techniques to select hair also are popular. Although somewhat of a generalization, the long pulse alexandrite and diode lasers are the most effective for hair removal in light skinned individuals. Nd:YAG devices are typically less effective especially for lighter/thinner hair but provide a great safety margin in darker skin where they are typically the preferred device.[2-4] Intense pulse light devices provide efficacy in the middle and routinely have a much larger spot size than any laser device as well as have the potential to treat a variety of conditions given the broad spectrum of wavelengths emitted. However, they are also typi-

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cally not suitable for darker skin. Although many publications and meetings have spent considerable time proclaiming these advances, several companies have been exploring the possibilities for simple to use, less powerful devices that can provide reasonable results. These devices typically have very few options in regards to energy settings, pulse width, spot size, hertz, and degree of epidermal cooling.

Many may be unfamiliar with home or patient use light devices because most research in this field does not appear in peer-reviewed journals. Companies sponsoring research typically withhold publication of results until products are ready for public sale in an effort to maintain a competitive advantage. However, this approach is not limited to laser companies; therefore, much of what is presented in this article will be based on my personal experience and on very limited medical evidence.

To begin, some may doubt that light-based devices can be used appropriately by patients. Published peer-reviewed data to date such as that by Rohrer and coworkers,[5] in which patients administered self-treatments using a small office-based device, indicate this is possible. In his study of 73 individuals (67 completed the study), patients were able to correctly administer their own treatments. Side effects did occur, such as hyperpigmentation (4.75%), crusting (2.35%), hypopigmentation (1.55%), and blistering (1.4%), although all side effects resolved by study completion. These types of studies are important but do suffer from the artificial nature of the research environment, where patients are observed as opposed to being truly in their own home without someone to readily answer any questions or rescue them from a serious mistake.

The true test of knowledge may not be whether a patient can properly discharge laser energy to the skin but whether the individual can recognize pitfalls before a complication occurs. It is not clear from the literature available that patients can do this. As an example, slight graying of the skin can occur if excessive energy or inadequate cooling is used during hair removal. Most laser experts can recognize this change before a large area is treated and adjust accordingly so that any side effects are minimal. Although the color change is typically obvious to laser experts, it remains to be seen whether patients can detect these subtleties. There is the possibility that, in the future, patients will not need to develop these skills. Instead, lasers may be able to detect potential problems and autocorrect, but such technology is not currently incorporated into commercially available devices.

Although the reader may now accept that patients can safely perform home laser hair removal, he or she may still doubt that a low-fluence home device could provide any meaningful results. A brief review of the proposed mechanism of action of laser hair removal will assist in explaining how these new devices obtain acceptable results but still "fit in the palm of your hand." For a more in-depth review of the mechanism of hair removal, the reader is recommended to consult a more authoritative text on the matter.[6,7] Hair removal can be explained through the theory of selective photothermolysis. For most laser procedures, the goal is to provide sufficient laser energy or joules that it is absorbed by the structure we wish to eliminate. This energy is converted into heat and, if a critical temperature is reached, the structure will not be able to repair itself. The wavelength of our device needs to penetrate deep enough into the skin that it reaches our intended target as well as well as be preferentially absorbed by the target compared with other structures within the skin. In the case of hair removal, wavelengths between approximately 650 and 1100 nm are absorbed by melanin, which is contained within the hair shaft, although it is also contained within the epidermis. Wavelengths less than 650 nm do not penetrate deep enough in the skin to reach all the critical structures necessary for hair regeneration, and those greater than 1100 nm have a limited absorption of melanin as well an increased absorption of water. It is generally advisable when trying to obtain long-term hair reduction with office-based devices to use the highest amount of energy that can be safely delivered to the skin without side effects. These higher fluences by and large produce greater degrees of hair removal, although the lowest possible fluence to provide results acceptable to patients is unknown. Schulze and coworkers[8] showed that 12 j/cm^2 could significantly improve pseudofolliculitis barbae (PFB) with a long pulsed Nd:YAG laser. This low amount of energy can be produced by hand-held devices in particular with diode-based lasers and intense pulsed light devices.

A principle from the theory of selective photothermolysis is that we desire the heating to occur in a time period shorter than the thermal relaxation time of the targeted structure. This is done to avoid excessive heat diffusion, which could damage adjacent nontargeted structures. The pulse dye laser is the prototypical example of this effect in action where energy in the millisecond range can be extremely localized to just vascular structures compared with older-generation vascular lasers, such as the continuous wave argon lasers, where scarring was a prominent side effect. As opposed to other laser targets, with hair removal we actually need some heat energy to be transmitted from the primary chromophore to cells adjacent to the hair shaft since some structures necessary for hair regrowth are either nonpigmented or do not have sufficient chromophore to absorb adequate laser energy. The use of too short a pulse width will result in damage just to the pigmented regions of the hair and does damage all the critical structures responsible for hair regeneration. Although Q-switched lasers, which are commonly referred to as tattoo lasers, do provide hair loss, they are in ineffective for long-term hair removal. They have the appropriate wavelength and energy; however, their pulse widths are so short that they are "too selective" and destroy the melanin within the hair shafts without the necessary collateral damage. The follicular units survive and are able to regenerate new hairs. They do provide temporary hair removal but do not provide the long lasting results which can be seen with long-pulsed, millisecond range, devices.

Although pulse widths longer than the nanosecond range provide the best results, the upper end of acceptable pulse widths is unknown. At some, yet to be completely defined higher pulse width, nonspecific bulk heating occurs. At this pulse width, the laser energy is initially absorbed by a specific target, but the time over which the light energy has been delivered is so long that multiple other nonpigmented struc-

Figure 1 TRIA laser from SpectraGenics, Inc. This device has a 1-cm spot size and capacitive sensors to ensure direct contact with skin before discharge of laser energy.

tures we do not wish to damage are injured by heat diffusion and this can result in scar. Thermal relaxation times are primarily estimated based on the diameter of the structures we intend to target. Pulse widths less than 100 millisecond were previously considered preferable for hair; however, work with home-based devices has challenged this ideas. Additionally, the use of longer pulses widths may seem counterintuitive at first because there has been the generally accepted but not proven idea that shorter millisecond pulse widths provide superior degrees of hair removal, especially for thinner/lighter hair. During the last several years, it has become clear that higher pulse widths have their place; in particular, they are better tolerated by dark-skinned or tanned individuals.[9-12] Adrian and Shay,[13] working with an 800-nm diode laser, were able to safely utilize higher fluences when using longer pulse widths (100 milliseconds) with few complications. Likely for any particular hair there are multiple combinations of energy and pulse widths that would be effective. For home-based devices, it is much easier to manufacture a small hand-held device that is higher in fluence if the pulse width can be extended. The ability to use very long pulse widths without excessively compromising safety or efficacy is currently crucial to the success of these devices.

Adding to the complexity of this discussion is that hair follicles vary greatly between individuals and even at different sites of the body on the same individual in many characteristics, including diameter, depth, and degree of pigment. These hairs will have varying absorption of light at different wavelengths based on melanin content and varying thermal relaxation times based primarily on diameter. Accordingly, although 12 j/cm^2 may produce improvement in PFB for a type VI skin individual, it may not produce improvement in that person's back hair let alone leg hair for a different type VI skin individual. One should also keep in mind that histologic confirmation of these theories is still lacking, as Orringer and coworkers[14] did not find significant differences in the immunohistochemical properties of follicles post laser treatment as would be expected.

Independent peer-reviewed publications are currently lacking for any of the commercially available home-use hair devices. The only large peer-reviewed publication to date is a study sponsored by SpectraGenics, Inc., performed by Wheeland[15] on the TRIA personal laser hair removal system, which is currently the only personal laser hair removal system available in the United States. This rechargeable battery operated hand-held laser operates at 810 nm and the current commercial version has 3 settings: low (7 J/cm^2 PW 125 ms), medium (12 J/cm^2 PW 225 ms), and high (20 J/cm^2 PW 400 ms), which are values slightly different from that studied by Wheeland. The device is shown in Figures 1 and 2 as well as

Figure 2 Angled view of TIA laser. Device includes enclosed rechargeable battery and can be held in one hand.

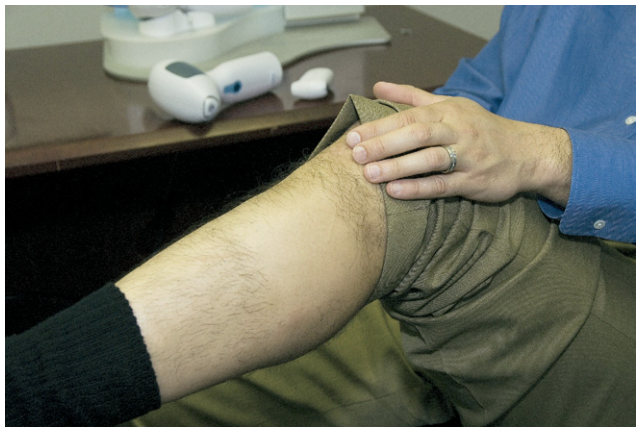

Figure 3 Photograph provided by SpectraGenics of an individual who had a hair-bearing region of leg treated with the TRIA laser.

a photo provided by SpectraGenics of an area of the leg treated with their device (Fig. 3). It has been cleared by the Food and Drug Administration (FDA) for at-home use to treat unwanted hair on the bikini area, legs, underarms, arms, back, and stomach. It is not FDA approved for use on the face, head, or neck likely, because of the few patients in Wheeland's study who had facial treatments performed. This system is an 810 diode, and Table 1 provides a list of several office-based hair-removal lasers for a comparison.[16]

The TRIA system is available from about 30 different physician offices currently, and the company plans to sell direct to patients later this year online as well as at spas and certain retail stores. The current price for this device is $995. The company recommended directions are for use every 2 to 4 weeks for 6 to 8 treatments per area. In Wheeland's study, mean hair reduction was 70% at 3 weeks after the second treatment and 41% at 6 months after the third self-administered treatment.

The only other currently available home hair removal device approved by the FDA is the Silk'n, from Home Skinovations, Ltd. This intense pulse light device emits energy from 475 to 1200 nm and can deliver up to 5 J/cm^2, delivering a pulse every 3.5 seconds with a 2 cm by 3 cm spot size. Information published on the company's website includes a

Figure 4 Photo of Silk'n intense pulse light device from Home Skinovations within base unit.

study involving more than 150 female patients who performed 3 self treatments at 2-week intervals at a physician's office. Six-month follow up data are reported as having an average hair reduction from 41% to 54% depending on part of the body.[17] The device is listed as $800 and can currently be purchased from approximately 50 different physician offices within the United States, which can be located from their website. The device has a replaceable lamp cartridge good for 750 shots, which is estimated to be sufficient to treat an area such as the legs several times. This device is also not recommended for face or neck treatments at this time nor for tanned or dark-skinned individuals. Figures 4 to 7 provided by Home Skinovations, show the device and one patient 3.5 months after her eighth treatment.

There are several other companies with laser and intense light devices currently being developed for hair removal. Although the currently approved hair removal devices are lim-

Table 1 Comparison of Office-Based Hair-Removal Lasers

Company	Product	Wavelength (nm)	Max Energy (J/cm^2)	Pulse Width (ms)	Spot Size	Listed Starting Price
Aerolase	lightpod Neo XT	1064	1274	0.65 to 1.5	6.8 mm	$46,500
Alma	Soprano XL	810 CW	120	10 to 1350	12 by 10 mm	$79,900
Candela	GentleLase	755	100	3	6 to 18 mm	$79,900
	GentleYag	1064	600	0.250 to 300	1.5 to 18 mm	$79,900
CoolTouch	Varia	1064	500	0.3-continuous	2 to 10 mm	$59,950
Cutera	Xeo	1064	300	0.1 to 300	10 mm or 10 by 30 mm	$85,000
Cynosure	Apogee	755	50	0.5 to 300	12.15 mm	$89,000
	Acclaim	1064	300	0.4 to 300	12.15 mm	$89,000
DermaMed	DermaYAG	1064	300	150	1 to 12 mm	$49,900
Focus Medical	NaturaLase LP	1064	400	0.5 to 100	3 to 15 mm	$69,900
Lumenis	LightSheer	800	100	5 to 400	9.12 mm	$79,900
MedArt A/S	MedArt 435	810	1000	10 to 1000	5.7 cm^2 scanner (8-mm pulses)	Not listed
MedSurge Advances	MeDioStar XT	808	90	500	4 to 14 mm	Not listed
Milesman	Milesman Premium	800	100	5 to 400	10 mm	$72,000
Sciton	Profile	1064	400	0.1 to 200	9 cm^2 scanner (5-mm pulses)	$54,500

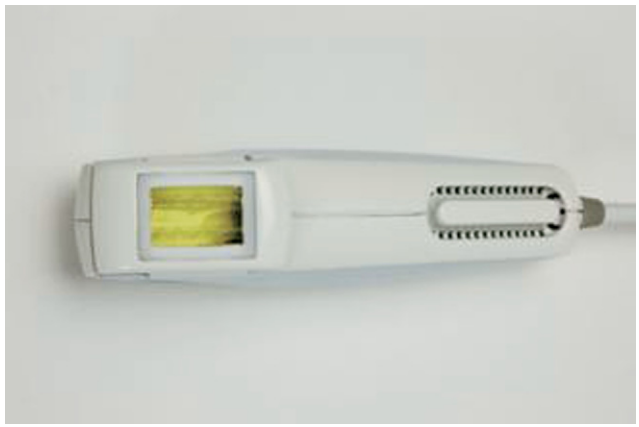

Figure 5 Photo of working end of Silk'n device demonstrating large 2 by 3 cm spot size.

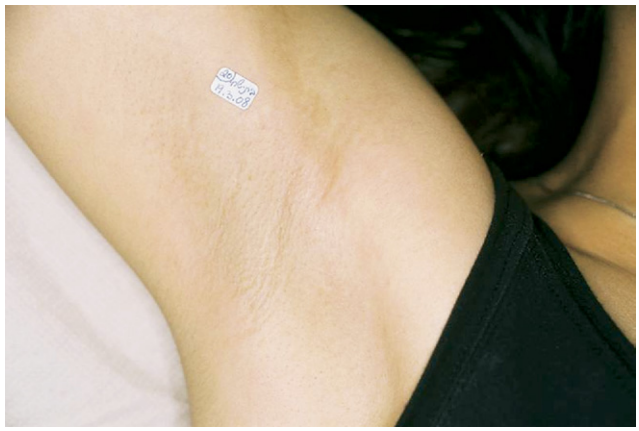

Figure 7 Same patient 3.5 months after eighth treatment with Silk'n.

ited to individuals with light skin, individuals with darker skin tones may have options in the future. As part of a congressionally funded Department of Defense investigation, a self-use device was developed in conjunction with Palomar Medical for the treatment of PFB. Although the scope of PFB in the military is too extensive to discuss in this article,[18] the final prototype device is shown in Figures 8 to 10, as well as one patient's PFB before and 4 weeks after completions of the study. Although the device is designed for self-use, the study involved physician performed weekly treatments for 5 weeks. Photographs from patients before and after completion were placed in a random order and then scored by blinded board certified dermatologists. A total of 95% of the subjects in the study had a greater than one unit improvement on a 4-point scale in at least one category for PFB (pigmentation, papules and pustules, cobble stoning texture, or overall assessment). This work, performed by the author, is also not published in a peer-reviewed journal at this time.

As noted previously, compared with office-based devices, current commercially available home devices provide their light energy over a very extended pulse width in the 100s of milliseconds. When attempting to create a small portable device, something must be sacrificed to obtain sufficient energy. Factors that can be altered to provide sufficient fluence while still maintaining an ergonomic device include: reducing the spot size, extending the pulse width, and reducing or eliminating any active epidermal cooling.

Outside of the United States, additional home devices are approved, such as the Rio Laser Hair Removal System (Cheltenham, UK), Epila Laser (BNB Medical Co. Ltd., South Korea), and LB500 (Optodyne, Compton, CA). Physicians should be prepared for some patients to seek these devices because they are cheaper and can be purchased through several methods, including e-Bay. Their efficacy is unknown; however, based on available information about the products, they are likely inferior to the 2 currently FDA-approved products. There are also nonlight-based devices for hair such as the no!no! by Thermicon (Radiancy Inc, Orangeburg, NY).[19] Finally, it should be mentioned that there is also the HairMax LaserComb (Lexington International, LLC, Boca Raton, FL), and the Laser Hair Brush (Sunetics International, Las Vegas, NV) which is FDA approved for the promotion of hair growth in males with androgenetic alopecia who have Norwood Hamilton classifications of IIa-V and Fitzpatrick skin types I to IV. This devices uses 650-nm diodes.

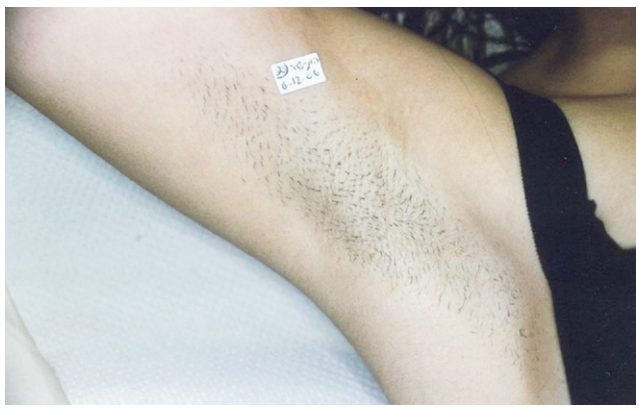

Figure 6 Photograph provided by Home Skinovations of a patient's axilla before treat.

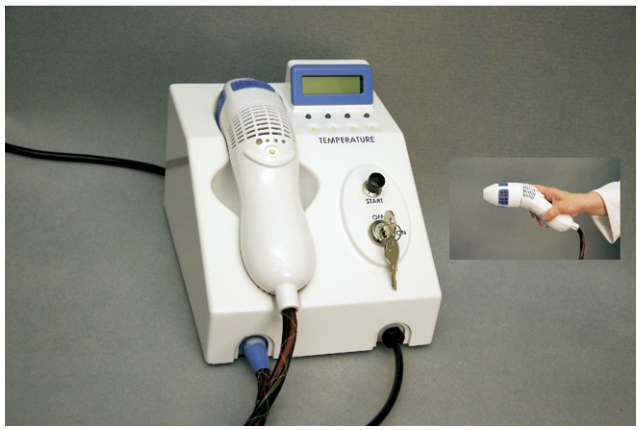

Figure 8 Photograph of prototype device for the treatment of pseudofolliculitis barbae.

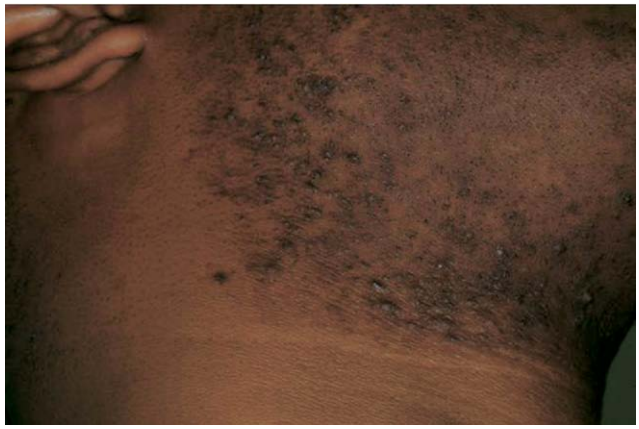

Figure 9 Photograph of patient's PFB before treatment with prototype.

Concerns

Although the advent of home use lasers is exciting and I personally believe their time has come, it is important to briefly discuss concerns regarding their use. Available peer-reviewed studies as well as nonpeer-reviewed data and presentations to date show self-use laser and light devices to be safe and effective. These studies are carefully controlled as well as sponsored and may not reflect the actual complication rate when patients are using the device outside of a clinical trial. In my experience regarding office-based equipment, when patients have come to me regarding complications they have had at another laser institution, most have been from laser hair removal or intense pulse light treatments, though many consider these nonablative treatments low-risk procedures. Much of this likely relates to the large number of hair removal procedures that are performed in this country and that, although a low-risk procedure, the sheer volume of procedures accounts for my observations. I have also noticed that none of the patients whom have presented to me had their treatment performed by a physician. My observations do not have any statistical backing and may differ from other laser specialists.[20] Fortunately, most of these complications

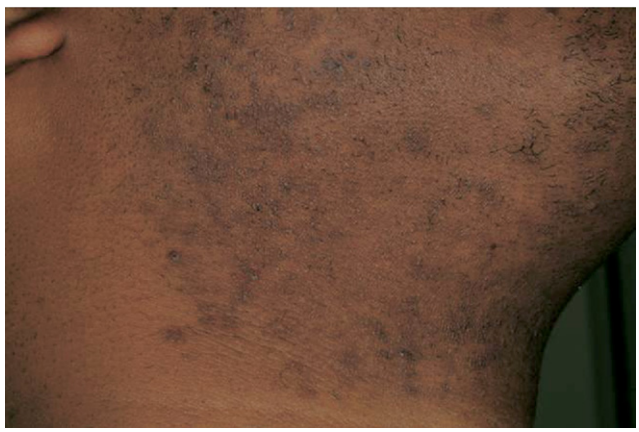

Figure 10 Photograph of patient's PFB 4 weeks after final treatment with prototype.

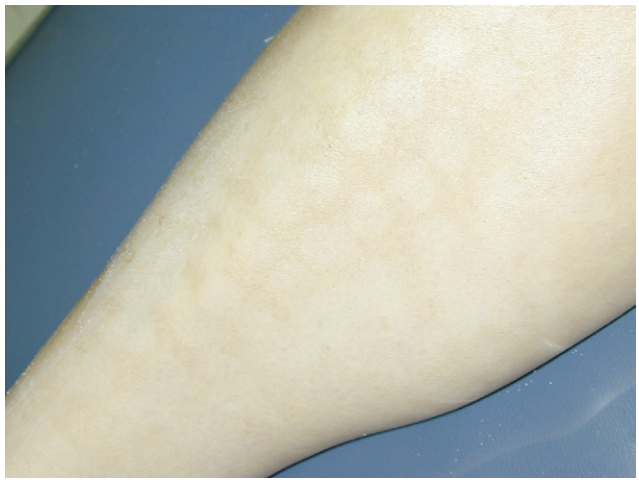

Figure 11 Photograph of hypopigmentation from hair removal laser performed on a patient with a recent tan. This complication normally resolves in less than 1 year.

are self limited, although they may take significant time to resolve, such as the hypopigmentation observed in Figure 11 of a patient who had hair removal at another institution. Some complications are unfortunately permanent and are typically caused by severe epidermal and dermal injury from inappropriate wavelengths, inadequate cooling, and/or excessive fluences of energy (Fig. 12). Side effects certainly occur with office-based laser devices even in the hands of very experienced laser experts, but these providers are knowledgeable on how to handle these difficulties.

Some patients will simply not obtain the type of results they were hoping for with these new devices. These individuals may be misinformed about the potential for benefit, have unrealistic expectations, or have hair and/or skin color not suited to the device they have purchased. These concerns also exist with office-based lasers and light devices as well. Al-

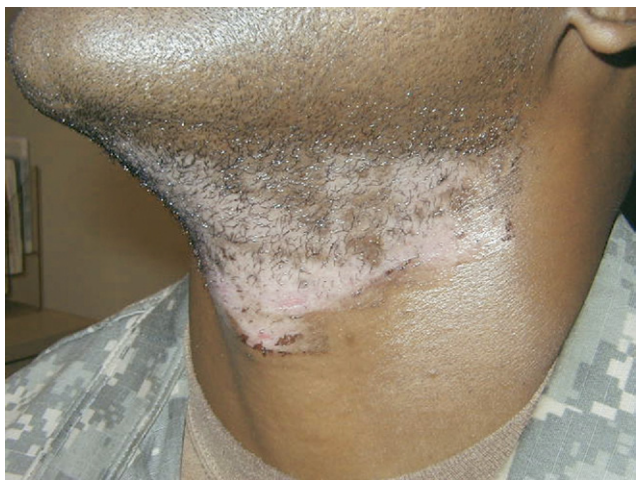

Figure 12 Photograph of a patient whose PFB was treated with an intense pulse light device. Even with improved epidermal cooling and light filtering techniques of newer generation intense pulsed light, treatment of types V and VI skin with intense pulse light for hair removal is not recommended

though home self-use devices are impressive, especially given their size, they do not have the same energy output nor degree of epidermal cooling that office-based devices poses. When a patient has spent almost a thousand dollars on a device to remove unwanted hair and has been unsuccessful, that person may proceed to unstudied augmentations in a misguided attempt to improve their results. Some of the more traditional methods of hair removal, such as waxing and chemical depilatories, when appropriately timed, or prescription medications, such as eflornithine HCL cream (Vaniqa), likely will be useful as they can be with office-based devices.[21] Use of home laser devices in combination with office-based hair removal is also likely to be of assistance in particular to get rid of thinner or less pigmented hair that the home-based devices are unable to remove. However, the excessive use of home-based devices may thin or lighten hair to the point where it is actually more difficult to remove with office based devices. Current guidelines on use of home devices are extremely limited. Even more concerning would be the possibility that after obtaining some cursorily information regarding the mechanism of hair removal or other electronic information that a patient attempts to alter a device in ways which are unsafe. I am constantly impressed with how quickly electronic devices that arrive on the market become "hackable" with directions found on the internet. There is currently several forums on the internet for hair removal with varying types of advice on how to augment available therapies. Patients may also use excessive number of passes or perform treatments on too frequent an interval. The laser energy used for hair removal is not ionizing; however, some oxidative stress does exist. Whether this could lead to a skin cancer such as squamous cell carcinoma (Marjolin type of effect) is unknown. It likely will take at least 10- to 15-year data to determine if such a concern should exist.

I think it is important to mention that laser companies are aware of the multiple concerns that exist with bringing this technology to market and make substantial effort to address them. As an example, Spectragenics has a program to ensure their device is used only on skin types I-IV, including a skin tone chart on the box, a requirement of phone activation where patients must answer questions about their skin type to receive an activation code, and finally a pigment detection device that comes with the TRIA. An acceptable level of pigment must register, which will allow this device to unlock the TRIA laser. This final requirement is necessary each time the device is turned on. These steps should greatly reduce the risks associated with tanned or slightly darker skin for any patient whom is attempting to appropriately use the device. Likely, there will be rare individuals who will intentionally find a way around these safeguards.

Eye safety is a constant concern for those who use office-based devices. The home devices noted in this article are class I devices and intended for use without additional laser eye safety such as goggles. Most companies have or are developing sensors to ensure contact with skin before discharge of laser energy. Although not perfect, they will prevent individuals who are properly using the device in approved locations of the body from accidental harmful exposures. It is not currently possible to prevent wrongful discharge from patients who purposefully circumvent safeguards.

Paradoxical hair growth has been seen with office-based laser hair removal. This is typically seen in genetically susceptible individuals when treated at suboptimal fluences at shorter wavelengths.[22-25] Although studies published to date on home use devices have not show paradoxical hair growth at low fluences, the author has seen leukotrichia occur in a 23-year-old man who was receiving low fluence NDYAG treatments to produce temporary improvement in his PFB. This individual did not wish to have permanent hair removal and this was the reason for the low fluence settings. The white hairs eventually resolved.

Use over the maxillae and mandible with deeper penetrating devices could potentially impact teeth if done frequently enough. Although the currently approved devices are not approved for facial use, undoubtedly some patients will perform treatments on the face. These changes may not necessarily be negative and may possibly improve gingival disease.[26] If found harmful, appropriate mouthguards can be implemented.

A final concern regarding safety, involves treatment for discomfort related to the procedure. Laser hair removal has some degree of discomfort, even with these low-energy devices. Although many patients can withstand this discomfort, some will look for methods of reducing it. In today's society, the ability of a patient to acquire narcotics, anxiolytics, or even excessive amounts of topical anesthetics should be considered.

The Future

Many of the aforementioned concerns may seem alarmist in nature, and I should point out, on the other hand, that I believe many new indications will arise for home use laser and light devices. Some may be possible from the devices that are already on the market or in development for hair removal. As an example, promoting tissue remodeling for mild rhytids or acne scarring is a potential candidate. The wavelengths used by these devices have been shown to have mild improvements in some patients for rhytids and acne scarring.[27,28] Many laser experts feel that results from nonablative devices can be improved with additional treatments beyond the 3 to 4 usually performed in an office-based treatment package. A home use device could facilitate a long-term treatment plan requiring multiple treatments. After completion of the PFB protocol noted previously in this article, approximately 6 patients asked to be treated at low fluences on a monthly basis to maintain their results. All of these patients reported smoother skin and improvement in acne scarring after approximately 6 months of additional treatments. These changes were not objectively measured.

Home laser and light therapies could to be developed for acne, which currently is treated with relatively lower energy settings compared with other conditions.[29] It is also a condition where short pulse widths are unnecessary and the ability to use longer pulse widths would facilitate development of a small device. Many protocols for acne require frequent such

as weekly visits and this could spur demand for a home device given the inconvenience and cost of travel. PDT is another therapy where home use could be possible. Although PDT can be uncomfortable, alternative therapies such as liquid nitrogen, imiquimod, and 5-FU each have discomfort and downtime. If patients were given a small amount of a photosensitizer as well as a device with a small treatment window, it would seem feasible. Vitiligo and psoriasis laser devices on the market are currently fairly compact and use standard voltage. As costs reduce over time, these treatments may too find a place in the home similar to home light boxes. Because these are conditions where patients do not necessarily need a device indefinitely, renting may become an option.

Areas in which I believe we are a long way from developing home-based laser technologies include conditions where a large spot size combined with a high fluence and short pulse duration is necessary for efficacy. For instance, the treatment of port wine stains will unlikely become home-based even if eye safety wasn't an issue. Typical treatments in my hands involve a 7-mm spot size with fluences of 10 to 14 J per cm^2 and pulse widths of 1.5 ms or less. It is not technically possible to create a miniature device that can produce this kind of energy at this point in time. I also expect ablative therapy including ablative fractional therapy to remain office based. Most ablative therapy in my hands, to be fairly effective, requires treatment parameters to a depth within the dermis such that devices can not be miniaturized to the extent necessary at this point in time. Ablative treatments, including fractional, also require a level of anesthesia that would be unsafe for patients to perform at home. Although initially there was significant hope that low energy lasers could assist in wound healing, information to date has conflicting results at best.[30]

When computers were first invented, they took up an entire room and required extensive knowledge to operate. Early predictions were that some day large computers would be created that encompass an entire building. Of course, for the most part, computers have become substantially smaller, more powerful, and easier to use. Lasers in my own view are likely to have a similar fate. "Will these devices put laser centers who perform hair removal out of business"? This is a question I am frequently asked by colleagues. Although it is not possible to exactly judge the impact these devices will have on the number of office-based procedures, there are reasons to believe the impact will be minimal. These devices are best suited for individuals who can set aside the considerable amount of time necessary to complete these procedures, have thicker and darker hair that provides a better chromophore for low fluences, do not have the economic resources for office-based laser, will be satisfied with lesser degrees of hair reduction, and value the privacy of doing these treatments at home. Interestingly enough, I have had several colleagues express delight in the idea of fewer patients seeking assistance for laser hair removal. This is likely a result of the long treatment times for large body areas even with office-based devices as well as the diminished profit from providing such services because they are now readily available in the community from a variety of sources at relatively lower prices.

As someone who has used and researched these at home devices, a practical point id like to make is that many of these devices operate better in a cool room as opposed to a warm room. The treatments are typically better tolerated with a wider safety margin as the devices are better able to cool the skin.[31] Additionally, although some patients may not be able to tolerate the highest and most effective settings on their initial treatments, many will be able to increase the power level setting without additional discomfort on subsequent treatments. This likely secondary to a reduced number and/or thickness of hairs remaining. Patients who are initially discouraged by the pain at the highest setting should be encouraged to re-test their pain tolerance after 2 treatments. Finally, I will mention that in unpublished research I have performed at 810 nm, 920 nm, and 1060 nm using low fluence, alopecia, although lasting for months, was always temporary. My results may not be applicable to other devices currently available or under investigation. This work was primarily directed toward treatment of PFB. There are actually some advantages to temporary removal. In the military setting, soldiers can have a clean shaven appearance while on active duty but later on in life decide to grow a full beard.

Conclusions

Available peer-reviewed studies as well as nonpeer-reviewed data and presentations at medical meetings to date show home self-use lasers and light devices to be safe and effective at least for hair removal. As with all new technology and medications that come to market, additional studies and post marketing surveillance will be necessary to further validate the efficacy and safety of these devices. Just as improvements have occurred with office-based light devices, improvements in efficacy, ease of use, speed, comfort, and safety among other factors will undoubtedly continue for these miniature lasers and intense pulse light devices. Given the large market for hair removal products alone, one can expect several companies to research and develop technology for this niche. Although hair removal and hair growth products are the current focus of available home laser and light based products, likely other indications will come to market.

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