



# Shedding Light on LEDs

By Amy E. Hamaker

Fascination with visible light has been constant, from Isaac Newton's famous prism experiments, to the use of color in Chinese traditional medicine, to the current interest in light-emitting diode (LED)-based aesthetic treatments. More LED devices are available than ever before, and public and physician interest has quickened. The real trick, however, is in measuring how effective LED treatments are in current clinical applications. Clinical use has evolved from blue light acne treatments to a range of wavelengths used for a number of medical and aesthetic treatments. This article reviews the latest research and looks at current clinical applications.

Just as plants use chlorophyll to convert sunlight into cellular building blocks, light-emitting diodes (LEDs) trigger natural intracellular chemical processes that can produce a host of effects in the body, says Marcel Besse, vice president, sales and marketing, Light BioScience/Gentle-Waves. "We experimented for years with pulsing technology on fibroblasts, turning on the cells themselves rather than increasing the blood flow through a thermal induction process."

istock photos

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➤ The new portable Lumière Spa from Photo Therapeutics delivers pure 633nm red light.

### QUESTIONS TO ASK

Before you purchase any LED device, be sure to do your homework. Here are some important questions to ask:

- 1 Does the device deliver light at the specific wavelengths you need for the applications you desire? Different wavelengths are absorbed by different photoacceptors. Ask for research that shows the effectiveness of the device in reaching your desired targets.
- 2 Is the intensity of the light being delivered sufficient to produce a cellular response? Ask for research that shows the particular device has produced the desired effects.
- 3 Can you do body treatments as well as facial treatments? How long will a typical treatment take?
- 4 Will the company provide the desired training and support? At what cost?
- 5 Is the device being used in other medical aesthetic practices? Ask to speak with doctors already using the product and quiz them about their experiences.

“The nature of true phototherapy does not lie in thermal injury,” explains Dr. R. Glen Calderhead, DrMedSci, FRSM, medical adviser to Photo Therapeutics, parent company of Omnilux and Lumière. “When effective wavelengths are aimed at the photobiomodulation zone, skin cells remain alive and unharmed, but they receive an energy boost from the direct, athermal exchange of energy between photons and cell components. This can help repair damaged cells, induce mitotic cells to replicate faster and cause cells to accomplish specific tasks more efficiently.”

According to Lynn Ludlam, marketing director for Omnilux, the first LED units were akin to the first computers—large and a little unwieldy. “The trick was getting the LEDs spaced properly, and getting proper cooling,” she says. The 633nm red wavelength was originally used with a photosensitizing product to remove nonmelanoma skin cancers and actinic keratoses. Physicians soon noticed improvements in the texture and appearance of the skin surrounding the keratoses.

“Dr. Mary Dyson at Guy’s Hospital London showed that red light at 633nm increased the synthesis of fibroblast growth factor from macrophage cells,” explains Dr. Calderhead, and this is the most commonly used wavelength for skin rejuvenation. Blue light at 400nm to 412nm is most commonly used to treat acne.

The GentleWaves unit from Light BioScience uses visible yellow light at 590nm, at a short 35-second, low-power burst. Other units, including the Omnilux and Synergie by Dynatronics models, add near-infrared wavelengths of 830nm and 880nm, respectively, to blue light treatments.

“Our experience tells us that a combination of the 880nm and 405nm wavelengths is an extremely effective treatment

for acne,” explains Kelvyn H. Cullimore, vice chairman and founder, Synergie by Dynatronics. “Although a small amount of heat is generated, the 880nm wavelength is mainly biostimulatory in nature.”

“Three things are important in getting results from LED devices,” says Paul Cenac, MD, Agape Medi Spa & Laser Center, Woodstock, Georgia, who uses the LightWave Professional from LightWave Technologies. “You need the right wavelength, the right hertz (number of times the light flashes per second) and a large enough dosage of photons to activate the cell function you are targeting. The LightWave has an array of 3,000 diodes compared to the five or six you see in some handheld devices.”

The machinery itself has grown more sophisticated. Some units use self-tracking technology to monitor results; the ClearLight system, for example, uses digital photography, touch-screen lesion counting and graphing. The LightWave has 15 computerized programs that make it easy to set the wavelength, hertz and dosage (time) for optimal results when treating specific issues such as facial rejuvenation or hair regeneration. Others, such as the Sapphire Abrastim 200 from Raja Medical, combine additional aesthetic modalities with LEDs. The Sapphire combines a sapphire granule-tipped, suction-free abrasion system with red LED (650nm), microcurrent and blue



▲ Note improvement in periorbital wrinkles on right over baseline four months after series of eight treatments with GentleWaves LED therapy.

Photos courtesy of Robert A. Weiss, MD

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### MAKING LEDS PAY

Used alone, LED devices produce only subtle differences after prolonged use, which makes selling LED services difficult. To help attract more interest in LED treatments, some medspas are selling "smart cards" that offer patients unlimited access to the device for a specific period. Both Revitalight and CureLight promote smart card programs.

When LEDs are used as an adjunct to other treatments, the cost is usually rolled into the cost of the primary treatment. None of the physicians we interviewed charged separately for the treatments. Mitchel P. Goldman, MD, clinical professor of dermatology at the University of California San Diego and medical director at La Jolla Spa MD, La Jolla, California, believes adding LED treatments to other therapies gives his facility an edge over other medspas.

LED (450nm). Small probes, full-face devices, and even full pads, such as the Synergie Dynatron XP Light Pad that's flexible and can wrap around large areas, have made LED accessible as a treatment for any body part.

### Acne Application

Several recently published studies have shown just how effective LED acne treatments can be. In one, "Blue and Red Light Combination LED Phototherapy for Acne Vulgaris in Patients with Skin Phototype IV," (*Lasers Surg Med* Vol. 39, 2007), patients with mild to moderately severe facial acne were treated with LED devices twice a week (the first with blue at 415nm, the second with red at 633nm) for four weeks, with a three- to four-day interval between treatments. Researchers found that mean percentage improvements in noninflammatory and inflammatory lesions were 34.28% and 77.93%, respectively, and that melanin levels significantly decreased after treatment.

Researchers from the Mount Sinai School of Medicine in New York City combined blue and red light therapy with microdermabrasion on 22 subjects with mild to severe symmetric facial acne vulgaris ("Combination Blue [415nm] and Red [633nm] LED Phototherapy in the Treatment of Mild to Severe Acne Vulgaris," *J Cos Laser Ther*, June 2006). Subjects were given eight 20-minute sessions, twice a week, alternating between 415nm blue and 633nm red light; subjects also received a mild microdermabrasion before each session. The mean lesion count was reduced by 46% at four weeks, and by 81% at 12 weeks.

### LED as Treatment Adjunct

"I really see LED treatments as tangential, rather than primary applications," adds Mitchell Chasin, MD, medical director

of Reflections Center for Skin and Body in Livingston, New Jersey. "If you're performing nonablative laser treatments, it's a great way to get results; if you're performing ablative treatments, you'll see a decrease in postoperative redness. Coupling blue and red light with an ablative system works very well; it enhances the depth of ablation and increases benefits."

"LED treatments work well after any procedure that causes erythema and irritation, including chemical peels, lasers and IPL," says Mitchel P. Goldman, MD, clinical professor of dermatology at the University of California San Diego and medical director at La Jolla Spa MD, La Jolla, California.

Dr. Cenac uses the LightWave as a pretreatment for his mesotherapy patients. "We use the cellulite setting on the LightWave to create ATP, which activates hibernating genetic fat cells. The phosphatidylcholine in the mesotherapy injection infiltrates the fat cells, leaving openings. Active cells more efficiently squeeze the fat out through these holes."

A case report in the August 2007 *Journal of Drugs in Dermatology* ("Combination of a New Radiofrequency Device and Blue Light for the Treatment of Acne Vulgaris") indicated excellent results with the use of radiofrequency energy [from Accent, Alma



▲ The epidermis is thicker with better cellularity and a much tighter stratum corneum two months after eight treatments with GentleWaves LED therapy.

Photos courtesy of David H. McDaniel, MD

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### RESOURCES

For more information on LED devices contact these manufacturers:

**CureLight**

908.470.4003  
curelight.com

**Edge Systems Corp./Delphia Del Sol**

800.603.4996  
edgesystems.net

**Light Bioscience/Gentlewaves**

888.647.6219  
lightbioscience.com

**Lumiere/Photo Therapeutics**

800.743.8150  
phototherapeutics.com

**OpusMed**

866.678.7633  
opusmed.com

**Raja Medical**

877.880.4184

**Sandstone Medical Technologies**

800.565.8721  
sandstonemedical.com

**Synergie by Dynatronics**

800.874.6251  
dynatronics.com

Lasers] and blue light 410nm [BLU-U, Dusa Pharmaceuticals] in combination to treat grade 4 cystic acne and acne scars in Asian women of skin type IV.

Studies in this area are continuing. Lumière has two new papers ready to be released on the effectiveness of combination LED treatments when used with the Fraxel laser, showing a reduction in healing time of as much as 50%. A similar study by Dr. Tina Alster of the Washington Institute of Dermatologic Laser Surgery, Washington, DC, on the use of the Light BioSciences GentleWaves in conjunction with Fraxel treatments is ongoing.

Dr. Goldman recently completed a study using the GentleWaves LED in conjunction with IPL treatments, which has been accepted for publication by the *Journal of Cosmetic Dermatology*. Fifteen patients received IPL treatments; one side of each patient's face was treated afterward with LED, with the other side left untreated. The investigator was blinded over which side had received LED therapy, and patients were given a questionnaire. Results showed a statistically significant improvement in erythema and irritation with the addition of LED.

One interesting study that emerged this year involved the use of LED photomodulation to prevent radiation-induced dermatitis in breast cancer patients ("Treatment of Radiation-Induced Dermatitis With Light-Emitting Diode (LED) Photomodulation," *Lasers Surg Med*, February 2007). Nineteen patients received daily radiation therapy to the whole breast using an IMRT technique and sequential LED treatments (using the GentleWaves unit); a control group of 28 patients were also studied. Researchers found that the LED group had a significantly reduced incidence and degree of skin reactions, resulting in fewer interruptions to their radiation treatments.

More studies do need to be done, however. "Patients today want to see results, and you have to be careful about over-promising what LEDs can do," says Dr. Chasin. "There's still a lot more research to be done."

Dr. Goldman agrees: "With more studies being done to document results, I'm hoping that more patients and doctors will come to see its value." z

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### A Selection of Studies

Here are three LED studies published during 2007. For a list of additional studies visit our website, [medestheticsmagazine.com](http://medestheticsmagazine.com).

"Efficacy of ALA-PDT vs. blue light in the treatment of acne," *Photoderm, Photoimmun & Photomed*, October 2007.

This split-face study of 20 patients with moderate to severe acne vulgaris compared ALA-PDT and blue light (415nm) treatments with blue light treatments alone. Patients received four treatments one week apart. Assessments at 4, 8, 12 and 16 weeks after the beginning of the treatments showed a mean percent reduction in inflamed lesions of 32%, 50.9%, 65.9% and 71.1% on the ALA-PDT-treated side and 20.7%, 27%, 57.7% and 56.7% on the side receiving only blue light. The percentage reduction on the ALA-PDT-treated side was higher but the difference was not statistically significant. Side effects of pain, stinging, peeling, erythema, pruritus, oozing and pustules were stronger on the ALA-PDT side.

"The use of light-emitting diode therapy in the treatment of photoaged skin," *J Cos Derm*, September 2007.

Thirteen subjects with periorbital and nasolabial wrinkles or fine lines, some presenting photodamage, received nine 20-minute light treatments over a five-week period, with combined wavelengths of 633nm and 830nm. Sun damage reduction was assessed at six, nine and 12 weeks; a majority of subjects displayed moderate (50%) or slight (25%) response

to investigator assessment. Treatment of the periorbital region was reported as more effective than treatment of the nasolabial region. At the 12 week follow-up, 91% of subjects reported improved skin tone; 82% reported enhanced smoothness of skin in the treatment area. "A prospective, randomized, placebo-controlled, double-blinded, and split-face clinical study on LED phototherapy for skin rejuvenation: Clinical, profilometric, histologic, ultrastructural, and biochemical evaluations and comparison of three different treatment settings," *J Photobiology*, April 2007.

Seventy-six subjects were examined for histological, ultrastructural and biochemical changes in their skin post-treatment. All subjects were randomly divided into four groups treated with either 830nm alone, 633nm alone, a combination of 830nm and 633nm, and a sham light treatment. Treatments were given twice a week for four weeks. Researchers measured skin specimens for elasticity and melanin during the treatment period and for three months following the treatments. Results showed a significant reduction of wrinkles (maximum 36%) and an increase in skin elasticity (maximum 19%) when compared to baseline on the treated face in the three treatment groups. There was a marked increase in the amount of collagen and elastin fibers in all LED treatment groups; highly activated fibroblasts were observed, surrounded by abundant elastin and collagen fibers and changes in key cytokines.