

Photomodulation Key to Controlling Cellular Processes of Skin Aging

By Bob Kronemyer, Associate Editor

Photomodulation is the unique science behind the GentleWaves light-emitting diode (LED) system from Light BioScience, LLC (Virginia Beach, Va.). This non-ablative, non-thermal therapy for reducing the signs of photodamage and skin aging involves transmitting specific packets of light that can be absorbed by receptors or antennae molecules associated with the mitochondria. Besides upregulating the production of collagen and elastin, the coded pulses of narrow band multispectral light also downregulate production of enzymes (collagenase) that break dermal tissue down.

“I’m very enthusiastic about this technology,” said David B. Vasily, M.D., a dermatologist in private practice in Bethlehem, Penn. “This is basically a new way of thinking about light and biology. You’re able to rejuvenate skin without having to create an injury that requires wound repair to achieve results.”

Several scientific papers on photomodulation were presented last April at the annual meeting of the American Society of Laser Medicine and Surgery (ASLMS). “These presentations were very believable. The whole biology of photomodulation made sense to me,” Dr. Vasily said. The low intensity light therapy regulates biologic activity in living cells. “You use less light energy than is emitted from a 25 watt household lightbulb,” Dr. Vasily noted. “However, there are very specific sequences of light pulses that activate certain sub-cellular systems.”



David B. Vasily, M.D.

The best analogy Dr. Vasily has created to explain photomodulation to his patients is a bar-code reader in a grocery store. “When you pass a specific bar code through the low-level red light coming out of the laserbeam, the red light breaks the bar code into specific codes that are recognized by the scanner,” Dr. Vasily related. “Only one item corresponds to that particular bar code. Similarly, with photomodulation, one coded sequence of pulsed low-level light functions exactly like we want it to – turning on subcellular machinery, the mitochondria, to initiate the production of new collagen and elastin.”

Dr. Vasily commented that aesthetic devices often flood the marketplace without ideal parameters already researched. “It is only after these machines have been out in the field and in the hands of researchers for a few years, that we optimize the treatment parameters.” In contrast, GentleWaves “is a lock-and-key device. The science precedes the marketing. The algorithmic pulsing codes are already built into GentleWaves. So you’re not starting from point zero and having to gradually learn by trial and error how to optimize treatment parameters. The only learning curve is how best to use it in conjunction with other devices.”

With most non-ablative devices, “you end up treating patients and then hand holding them for months and months,” Dr. Vasily continued. In addition, “the responses are so variable that many patients end up with no response or minimal response. This variability may relate to different factors involved in the production of collagen and likewise, the simultaneous production of collagenase, elastase or matrix metalloproteinase (MMP) enzymes.” Hence, “the net effect in certain patients, especially perhaps among smokers and tanners, has been disappointing. These patients already have very high baseline levels of collagenase, so laser treatments just induce more enzymes. It’s all about ratios.”

Dr. Vasily has found success using GentleWaves as both a stand-alone treatment and adjunctive therapy with other non-ablative devices “to turn off some of the bad stuff they just turned on.” He is impressed by combining GentleWaves with his EsteLux (IPL), CoolTouch and the V-Beam pulsed dye laser. “But



Typically, Dr. Vasily schedules two treatment sessions per week, for four weeks. Patients are exposed to the light for about 40 seconds. Optimal results are seen three to four months after final treatment. “We also encourage a maintenance session about once every six weeks,” said Dr. Vasily.

Because of increased patient demand, Dr. Vasily plans to acquire a second GentleWaves unit. “We’re building an addition to our center and we want to use GentleWaves as a synergistic treatment with all our other devices,” he said.

Not surprisingly, the new marketing message from Light BioScience for GentleWaves is “Skin Fitness.” According to Dr. Vasily, “The ultimate test of a good device is word of mouth referrals. The word of mouth about GentleWaves is spreading so quickly in the community that we are overwhelmed by the demand. We have not had to spend a single dollar in announcing its arrival or in marketing. The therapy markets itself.”

GentleWaves is also an ideal device because it is safe, simple, fast, effective, painless and risk free. “This system is incredibly safe,” Dr. Vasily added. In addition, “it is probably the simplest device in our center. You simply push a button.”

“Patients have a beautiful glow to their skin and complexion. In many cases, pore size has also been reduced.”

what really excites me is using GentleWaves in conjunction with the MicroLaserPeel (Sciton, Inc., Palo Alto, Calif.)”

Overall, Dr. Vasily has observed a global skin improvement with GentleWaves. “Across the board, there have been noticeable changes. At one month follow-up, the skin is creamy with a noticeable improvement in texture. Patients have a beautiful glow to their skin and complexion. In many cases, pore size has also been reduced. All of my patients are extremely happy, and it’s such a refreshing device to use, that it’s fun.”



Pre, 1, 8, 16, 24 weeks post GentleWaves LED Tx

All photos courtesy of David H. McDaniel, M.D./Light BioScience, LLC

Understanding the Science of Photomodulation

Photomodulation is a term which describes the use of low intensity light therapy to modulate up or down the activity of living cells. There is a complex interaction of light photons with certain 'receptors' in these living cells which produces this photomodulation effect. Extensive in-vitro studies on human cell lines have demonstrated the specificity of up / down regulation at the level of subcellular structures including gene activity regulation. A specific set of parameters of this low intensity light determines the effect and thus a 'photomodulation code' exists for such cellular actions. Various codes produce different effects and also different cell lines require unique codes depending on the pattern of modulation desired. In fact, it is possible to increase, decrease or have null effect on the same cell line for a given gene activity simply by changing the parameter code.

This photomodulation code encompasses a variety of parameters including the wavelength, bandwidth of wavelengths, energy intensity, multiple time factors such as pulsed or continuous wave and even treatment intervals. Thus, the code is actually a complex formula which regulates gene and cellular energy activities. For example, it is the narrow multispectral bandwidth of LEDs which produce greater magnitude of effects versus more monochromatic light sources such as lasers or very broad bandwidth sources such as IPL.

The effects on the electron transport system in cellular mitochondria is very important with the activity of certain key enzymes such as cytochrome oxidase and ultimately ATP production itself being profoundly influenced by photomodulation. Finally it is possible for a given cell line (human fibroblast as an example) to produce a more complex pattern of up / down regulation of genes and stimulation of cellular energy production so that one creates a change in the genotype being expressed by that cell line in order to produce a desirable clinical phenotype.

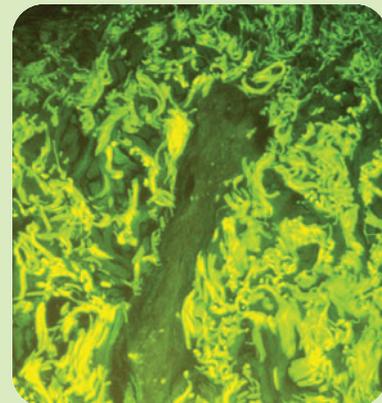
In-vitro studies on fibroblasts have demonstrated that LED photomodulation using yellow light with a selected code induces the increased production of a wide range of collagen proteins,

including key collagens for the skin's dermal extracellular structural matrix (ECM). Furthermore, simultaneously the induction of decreased production of the MMP enzymes which degrade structural proteins such as collagen I (as well as elastin, ground substance and other important structural proteins) can be produced.

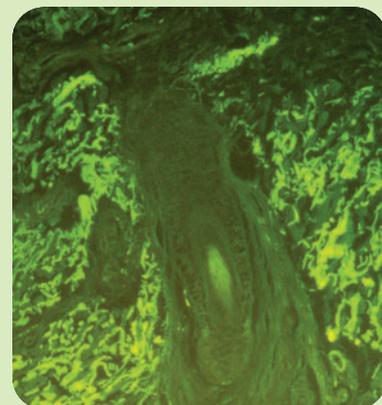
The net cellular effect of using such a code with LED photomodulation is to produce a very significant net increase in ECM including collagen. We know that various other environmental factors increase MMP production (such as UV light, smoking, etc.) and also in-vitro studies with laboratory models have demonstrated that UV light both decreases gene activity for collagen production while increasing MMP production — a scenario which produces a very significant net loss of collagen / ECM.

Clinical studies undertaken to examine the effect of LED photomodulation demonstrated in the in-vitro cellular models have been and continue to be conducted. The clinical phenotype representing the visible changes associated with photoaging as well as the changes in structural proteins observed by immunofluorescence staining of skin biopsies from these same subjects appear to mirror the in-vitro model in many ways. ■

Source: David McDaniel, M.D.; Roy Geronemus, M.D.; Robert Weiss, M.D.



Collagenase (MMP) Pre-Tx



Reduced MMP Activity Post-Tx

There is nothing for the technician to do other than to prepare and apply an enzyme mask that allows for the light to penetrate. The total in and out time ranges from 12 to 15 minutes.

“We initially thought patients would not take this treatment seriously,” Dr. Vasily conveyed. “But people love it. When they look in the mirror, they look good.” Studies indicate patients continue to improve for up to four to six months, even without maintenance. However, “virtually all of my patients who have completed a series of treatments have signed up for maintenance,” he added. Treatment is also totally painless and Dr. Vasily has yet to encounter any adverse events.

“GentleWaves truly represents the dawn of a new era in aesthetic procedures,” Dr. Vasily said. “The potential is just enormous, and everything is being confirmed in the laboratory.”

Tina Alster, M.D., director of the Washington Institute of Dermatologic and Laser Surgery in Washington, D.C., finds that the best candidates for GentleWaves treatment are those “who are just starting to show some fine lines or have had some



Tina Alster, M.D.

“GentleWaves offers superior rejuvenation compared to applying Retin-A, but without the potential irritation.”

sun exposure. Other patients may have mild dullness or discoloration of the skin.” Ideal candidates tend to be in their thirties and forties.

Dr. Alster normally schedules between 6 and 12 sessions, once or twice a week. “I have some patients that notice a change in their skin after only three or four sessions,” Dr. Alster reported. “They say that their skin appears brighter, less dull and slightly smoother.” Other patients require a full series of treatments before appreciating a change. “I think the skin looks a little better, and feels better as well. In fact, patients feel a skin improvement before they see it.”

Unlike Dr. Vasily, however, Dr. Alster usually leaves it up to her patients whether to pursue maintenance therapy. “Many of my patients tend

not to want maintenance,” she explained. “I would estimate it is half and half.” In any event, “the benefits achieved from a series of treatments are long-standing, but it does not prevent further photoaging or regular aging. Still, GentleWaves provides an overall appearance of skin fitness. We know that healthy skin indicates good, general health.”

Dr. Alster, a clinical professor of dermatology at Georgetown University, pointed out that she believes “GentleWaves offers superior rejuvenation compared to applying Retin-A, but without the potential irritation.” She also finds enhanced results when the device is used in tandem with non-ablative lasers, for example. “Because of its photomodulation effects, GentleWaves is a perfect device to use with the collagen producing aspect of these non-ablative lasers.” Microdermabrasion or mild peels can also improve the outcomes of GentleWaves.

Besides treating the face, GentleWaves can be used on the entire body, especially the lower legs. “At the present time, there are few modalities to reduce photoaging for the full body,” said Steven Bloch, M.D., a plastic surgeon in private practice in Highland Park, Ill. “We’re starting to see improvement in skin texture and pigmentation. You can treat large areas quickly and effectively.”



Steven Bloch, M.D.

For facial treatments, Dr. Bloch recommends eight sessions at one week intervals. “In most patients, you begin to see an improvement in both skin texture and fine lines by the middle of the treatment cycle,” he said. Maintenance sessions every one to two months afterwards are advocated as well. In addition, Dr. Bloch often combines GentleWaves with micropeels, microdermabrasion or CoolTouch non-ablative laser treatment.

“GentleWaves is an extremely easy procedure to sell,” Dr. Bloch concluded. “It is painless therapy and the patient cost is very reasonable, in part because the procedure does not take very long. It’s also easy to add on to any other ancillary procedures that patients may be having.”

Brian Biesman, M.D., clinical assistant professor of ophthalmology at Vanderbilt University Medical Center in Nashville, Tenn. also reports a positive clinical experience with GentleWaves in

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his practice in spite of initial skepticism. "My interest in this modality initially arose with the scientific presentations given at last year's ASLMS meeting. I was particularly impressed by the actual science behind the project. So often aesthetic devices are introduced under 510(k) FDA approval with minimal clinical experience and practically no science."

Dr. Biesman was "pessimistic about the ability of such a seemingly innocuous treatment to produce beneficial clinical effects. I remained skeptical but curious as I began treating patients. But to my surprise, I began to receive unsolicited praise for the treatments. After treating one patient five or six times I received a call from her aesthetician asking what I had done to make this patient's pores smaller. That aesthetician and several of her clients have subsequently become GentleWaves patients."



Brian Biesman, M.D.

Patients have reported smoother skin, decreased pore size, more even pigmentation (particularly on the neck and chest), and some decreased erythema," according to Dr. Biesman. "With the recent data on decreased MMP production, I have begun using GentleWaves following

CoolTouch 3 nonablative laser treatment. I am also using it in the immediate postoperative period following carbon-dioxide laser skin resurfacing. I find that the best candidates for treatment are those with mild photoaging who employ a good skincare regimen. I do not tell patients to expect to see wrinkle reduction, but rather overall improvement in their skin appearance and feel."

Based on favorable results, several patients have requested extending their suggested package of 8 to 12 treatments, and are continuing on a maintenance basis. "I am very excited about GentleWaves LED photomodulation and look for-

"I find that the best candidates for treatment are those with mild photoaging who employ a good skincare regimen."

ward to further refinements in clinical indications and treatment regimens, expanded applications, and a greater understanding of the science underlying this fascinating technology." ■

Editor's Note: None of the physicians quoted in this article have a financial interest in Light BioScience.

