

What's new and what's next in lasers

By Jan Bowers

ADVANCES IN LASER AND OTHER light-based technologies are leading to new treatments for conditions ranging from excess fat and aging skin to actinic keratosis and basal cell carcinoma. Several of the newest light-based procedures involve fewer treatments and little or no patient discomfort and downtime as compared to older laser or surgical procedures. "Many plastic surgeons are looking to see what we're doing, and are beginning to adopt what we as dermatologists have pioneered," says Roy G. Geronemus, M.D., director of the Laser & Skin Surgery Center of New York and clinical professor of dermatology at New York University Medical Center. "Some patients don't want the full invasive, much more expensive facelift, particularly in the context of the recession. Lasers can be costly, but they don't have to be anywhere near as expensive as the surgical procedures."

Resurfacing and Rejuvenation

Refinements in fractional resurfacing, also known as fractional photothermolysis, are generating new laser products that differ in their frequency, depth of penetration and indications. Introduced to the scientific community in 2004 by physicians at the Wellman Center for Photomedicine, Harvard Medical School, in a 2004 article published in *Lasers in Surgery and Medicine*¹, fractional photothermolysis was developed as a safe and effective laser treatment for photoaged skin that would avoid the side effects of ablative skin resurfacing with pulsed CO₂ lasers. The underlying concept is to thermally ablate microscopic columns of skin in regularly spaced arrays, leaving intervening areas of skin untouched.

"There's a new wavelength of the fractional lasers ... which has a wavelength of 1927 nanometers," says Dr. Geronemus. "It was designed for pigmentation, but it has an extraordinary effect on actinic keratosis. For the first time, this device allows for treating a very common condition with minimal downtime and considerable success."

The original device used for fractional photothermolysis was a 1550-nm erbium-

doped mid-infrared laser. More recently, several manufacturers have introduced fractional CO₂ lasers, which dermatologists now use to treat fine facial lines and wrinkles, rhytids, acne and burn scars, and nevi. Min-Wei Christine Lee, M.D., director of the East Bay Laser & Skin Care Center in Walnut Creek, Calif. and assistant clinical professor at the department of dermatologic surgery, University of California at San Francisco, describes one such CO₂ laser as, "probably one of the most significant devices in a dermatologist's armamentarium. It gives the dermatologic surgeon the full range of options, from doing minimally invasive procedures to the traditional CO₂ ablative resurfacing. You can't really do rejuvenation and be serious about anti-aging without having one of these devices."

Aside from continued refinements to fractional resurfacing, Dr. Lee says there are few new developments in laser treatments for the skin "because the companies are devoting their energies toward body contouring and fat melting. The other big area of research is developing laser modalities to treat skin cancer."

New Diagnostic and Treatment Modalities

Photodynamic therapy is already being used to treat basal cell and squamous cell carcinoma, particularly in Europe. Dr. Geronemus describes research at his center using intradermal injections of aminolevulinic acid with blue light. "The results are quite good, and I think this will provide an alternative to some patients who don't want surgical treatment, at least on the body," he says. "I wouldn't recommend it for the face, yet."

The dermatologist who led the Wellman Center research team in the development of lasers for permanent hair removal, port wine stain treatment and tattoo removal is also the father of fractional photothermolysis. R. Rox Anderson, M.D., director of the Wellman Center and professor of dermatology at Harvard Medical School, says ongoing re-

search is taking fractional technology far beyond its original purpose of treating photoaging. "Lasers are often looked at as highly expensive, specialized tools used mostly for cosmetic and aesthetic issues, and childhood problems like vascular lesions, but in fact they're probably going to enter mainstream medical dermatology as well," he says. "I'm very excited about the ablative fractional technology as a means for drug delivery. I'm studying photodynamic therapy, and one of the limitations there in treating cancer is the depth of drug penetration. With the fractional devices — in this case CO₂ and erbium lasers — you can go to whatever depth you like, just into the epidermis or way deep down. I think you'll see this application coming out pretty soon, for everything from aesthetics in an office-based procedure to corticosteroids or even large molecules."

Dr. Anderson cites in vivo microscopy as another promising application for laser technology, albeit one that is still years from clinical use. He lists three major approaches to creating images from inside living tissue: confocal microscopy, which uses a diode red laser; optical coherence tomography, which uses infrared lasers; and multiphoton fluorescence microscopy, which uses short pulses of light. "The confocal microscope that's available now for skin use is used as a research tool because it's expensive and there's no CPT code," he says. "But we know that the sensitivity and specificity of identifying cutaneous melanoma with that device is very high. My assumption is that in 30 years, it will be considered barbaric to take a skin biopsy."

More effective laser treatments for "unsolved problems" like acne and melasma may also be discovered as dermatologists develop a better understanding of these disorders, Dr. Anderson predicts. "Light as a tool is incredibly powerful," he says. "My excitement for the future is that as we learn more about skin and skin disease, it allows us to be more strategic in developing lasers and light-activated processes for treatment. I think it's going to get better and better." •

¹ Manstein, D, et al. Fractional Photothermolysis: A new concept for cutaneous remodeling using microscopic patterns of thermal injury. *Lasers in Surg and Med* 2004; 34: 426-438

