

SPECIAL REPORT

Come to the light

*In the great laser technology chase,
clinical advances still outpace
the iPod principle*

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► We live in a miraculous age. Thirty years ago, if I told most of the people reading this article that they could take a letter or picture and send it around the world in a matter of minutes, they would have thought that to be a massive advance. Enter the fax machine. If I told the same people 15 years ago that you could send text, pictures and video around the world in seconds, that would have been ultra miraculous. Enter the Internet and digital technology. Finally, if I told you just a few years ago that you would be able to carry your entire collection of record albums, 8-track tapes, cassettes and family movies on a device the size of a pack of cigarettes, you would have called me insane. We have seen so many technological advances over the past half century that we take them for granted. Television, polio vaccine, antibiotics, organ transplants, man on the moon, cellular phones, digital photography and iPods have changed the way we all live, work and play.

TOOLS THROUGH TIME The same exponential growth has been seen in cosmetic surgery. Prehistoric men utilized sharpened stones to cut flesh. The Bronze Age provided blades for incision and we remain pretty much stuck in that technology with our #15 scalpel blades. Shortly after the discovery of electricity, it was used to cauterize or burn tissue in the operating room. Early electrosurgical generators were basically soldering irons that could destroy tissue. By 1928, William Bovie, the famed Harvard surgeon, had harnessed the electricity to selectively cut and coagulate tissue. In 1999, the Ellman Company patented 4.0-radiowave technology, which was even more selective and controlled.

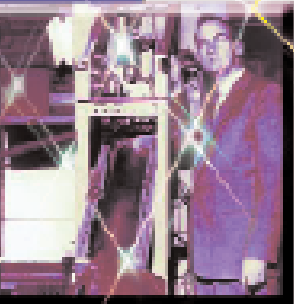
LASER LINEAGE Experimentation with light waves for military radar applications during WWII led Dr. Charles Townes to begin work on light emission with shorter wavelengths. In 1953, Townes and others demonstrated

a working device, which Townes called the maser, which stands for Microwave Amplification by Stimulated Emission of Radiation. They patented the device through Columbia University. This work continued and the principle of reflecting mirrors was added. Townes together with Schawlow in 1958 wrote a paper on their work — although they had not yet made an actual laser — and they applied for a patent through Bell Labs. They proposed that the principles of the maser could be extended to the optical regions of the spectrum, which was published in the December issue of *Physical Review*. Two years later, Schawlow and Townes received a patent for the invention of the laser, the same year a working laser was built by Theodore Maiman at Hughes Aircraft Company. Townes and Schawlow went on to win Nobel prizes for their work and interestingly quote their feelings at the time: “We thought it might have some communications and scientific uses, but we had no application in mind. If we had, it might have hampered us and not worked out as well.”

Given the fact that the inventors had no medical application in mind and appreciating this history, we went from 0 to 100 miles per hour in 50 years. During this time, the theories of selective photothermolysis and thermal relaxation time opened the door for precision tissue selectivity and the pulse dye laser emerged as the first gold standard for selective chromophore destruction.

PROBLEMS AND PROGRESS Over the past 15 years, we have seen the development of ultra pulsed technology and computer pattern generators that led to the laser resurfacing revolution that all but made dermabrasion obsolete. The steep learning curve of the CO2 laser, coupled with the media frenzy and corporate hype, proved that this new and effective technology could be fraught

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Dr. Charles Townes with his “maser” device.



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with problems. Disfiguring burns, permanent hypopigmentation and extended healing became problematic and the search continued. The Erbium laser appeared on the scene as a more gentle, friendlier laser and although it required less recovery time, it also provided less dramatic results.

Ensuing technology with vascular lasers led from the 585-nm wavelength with its purpura to longer pulsed 595-nm wavelength with less purpura. NG:YAG lasers with cooling technology allowed the treatment of larger and deeper vascular lesions with less melanin absorption,

which allowed its use in darker skin types. A super long-pulse diode laser of 810-nm wavelength allowed the laser energy to be delivered over a longer time which resulted in less epidermal damage and increased use with darker skin types. The 532-nm wavelength (also coupled with 940-nm wavelength) is generated with solid-state diode lasers that are clinical workhorses, as they are light and portable and produce little epidermal damage, making possible a lunchtime treatment.

In 1995, hair removal lasers were introduced and the long pulse alexandrite laser with a 755-nm wavelength became

a popular option. Tattoo removal lasers also appeared, further extending the clinical usage of laser technology.

LIGHT ENTERS THE SPECTRUM A step away from laser technology that represented clinical advancement was the introduction of photorejuvenation, which has many advantages when compared with laser resurfacing using ablative methods. Patients have no downtime, have fewer pigmentary changes, and need little to no anesthesia and less wound care. However, they need multiple treatments and results may not equal ablative therapy. Intense Pulsed Light (IPL) treatment emits a continuous light spectrum with most of the fluence between 515 nm and 1000 nm. The light source produces incoherent light with a spectrum that can be cut off with colored filters. A cooling gel used on the skin's surface protects the epidermis. These devices deliver longer wavelength, pulse duration and have a large spot size that increases efficacy. This technology has been very successful with the increasing vogue of minimally invasive cosmetic treatments. IPL is effective for the removal of things red and brown and, with multiple treatments or when coupled with photodynamic therapy, can produce impressive results. Although histologic studies show collagen synthesis and wrinkle reduction, I have not been impressed with this aspect of IPL.

Fractionated resurfacing treats selected areas of the skin while leaving untreated columns to lessen the recovery. Some CO2 manufacturers have figured out fluences and densities to mimic fractionated laser treatment without purchasing an additional laser. This technology has a place and is effective for pigment, fine wrinkles and skin health, but if the patient is expecting "CO2-type" results, they will likely be disappointed.

THE LASER AS DOORSTOP Mulling over the past 50 years, and most especially the last 15 years, we have seen a lot come and go. I have friends who have yellow light and Erbium glass lasers that were supposed to improve wrinkles and acne but now serve as expensive door stops.

The next logical question is what will the next 50 years bring? I think we are just at the starting gate. We have all been told that the public demands minimally invasive technology. The media has an insatiable appetite for this and the corporations that make these devices sometimes play right into the hands of the consumer and bypass the doctor. It is true that the public wants less-invasive treatments and the same was true hundreds of years ago in search of the fountain of youth. I sometimes feel that this minimally invasive search goes the wrong way. We are told that "less is more" but in reality, no patient wants less, they want more! Less is fine if the result is more, but less is not a good thing if the result is less. No one can argue with the fact that all laser practitioners and contemporary patients have seen many advantages with the progression of laser and light-based technology, but many times

these changes are overrated. Many practitioners have abandoned CO2 laser ablative treatment because of complications and extended recovery. Personally, I have continued to use my CO2 laser and have found ways to mitigate both undesired effects and recovery. Daily, I see patients that come for consultation and are disappointed and frequently disenchanted with a previous doctor because they shelled out thousands of dollars for treatment results that were in the brochure but just didn't happen. I explain to these patients that if they truly want a significant result, they have to "pay the piper" in terms of recovery. If you want to truly reverse decades of facial aging, then you must take 12 days away from life and sit it out. If you can't do that, you are really not serious about rejuvenation. Although that sounds harsh, it is a reality, not only with lasers, but also with other types of technology such as barbed threads and radiofrequency skin tightening. People spend thousands of dollars on many of these promising procedures and get very little out of it.

THE IPOD PRINCIPLE I have friends that have purchased laser or light devices that cost over \$100,000 and I can get better results with 50 cents worth of TCA with a face peel. This has led many practitioners to become hesitant about "new" technology. The iPod principle sometimes applies to laser and rejuvenation technology; that is: every time you get the latest product, a new one comes out. You can't outrace technology, so sometimes it is better to sit back and watch. It is the early adopters among cosmetic docs that usually get excited about new technology and most of them have been to the well and back. Some have truly found successful treatments (even with things that did not work well in my practice) and others have made very expensive mistakes based upon the desire to get the latest and greatest. It is unfair for me or anyone else to condemn any of the new technologies. They may not work in my practice because my patients expect very significant results that can be seen in before and after pictures. Other practices are more amenable to smaller and more conservative treatment results. What is true is that nothing succeeds like success and the true winners in ablative and or nonablative technology will be those technologies that endure the test of time. Time will tell, so we all must view the new stuff with both excitement and trepidation.

LOOKING AHEAD Laser and IPL treatments for vascular lesions, hair removal, tattoo removal and photodamaged skin continue to be exciting and quickly expanding arenas. The future holds many exciting possibilities as our understanding of selective photothermolysis, laser-tissue interactions and optics continues to expand. In the future, all of these factors will continue to advance, extending therapeutic indications. In this entrepreneurial society with aggressive manufacturers, savvy media and a gullible populace, we will have to endure the Edsels and hope for Ferraris. ◀

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