Danièle Aron Rosa, MD

Dr. Aron Rosa shares her success in developing the Nd:YAG laser and delivering quality patient care.

What led to your Nd:YAG innovations? Inventing the technology to deliver a noninvasive laser incision required me to determine a laser beam wavelength that would not disrupt the temperature or the integrity of surrounding tissue within 100 µm of the target. The infrared laser must deliver pulses using 1,064 nm of wavelength to avoid absorption by water, pigment, or hemoglobin. The ablation must also simulate the phenomenon of a storm with low emergent energy concentrated on a 20- to 30-µm area, thus creating a high-power density (12 watts/cm^2) to generate optical breakdown. The resulting ionized plasma will restore the beam's energy as a mechanical shock wave, thereby cutting the target tissue. By multiplying the Nd:YAG frequency, I was able to use the laser in various wavelengths.

When developing the Nd:YAG laser, how did you envision its future? I felt confident in the laser's ability to cut all ocular tissue. I primarily performed posterior capsulotomies, but tried to apply it to lens fragmentation, vitreous traction bands, iridotomies, and corneal refractive surgery. The non-patentable, nanosecond Nd:YAG laser was the preferred platform, but my concern with these multimode lasers was the possibility of inducing retinal detachment, vitreous hemorrhages, and permanent glaucoma. I was surprised when intelligent surgeons decided to perform intrastromal refractive surgery with a nano- second Nd:YAG laser, which is impossible due to the accumulation of ionized gas and reabsorption time that not only inhibit accurate ablations, but are extremely toxic to the cornea. Only ablations on open surfaces work effectively. Although I anticipated the transition from posterior capsulotomy and replacement of posterior capsule laser openings with photodynamic therapy to be difficult, I did not expect Nd:YAG laser capsulotomies to exist 25 years after my 1978 patent.

In your opinion, what current technology has the brightest future? With regard to anterior segment surgery, photodynamic therapy, to maintain the clarity of the posterior capsule, and noninvasive technology, to restore accommodation after cataract surgery, show considerable potential. With regard to the retina, in situ implantation and supplemental medication to treat and prevent macular diseases look promising.

What has been your most challenging case? At the beginning of my career, a friend from Rome presented with a severe orbital tumor, a fibrosarcoma of the orbital floor. I performed surgery under the supervision of my mentor, Guy Offret, MD, and completely removed the tumor. Four weeks later, my friend returned with a recurrent tumor. Dr. Offret advised the removal of the entire orbit, provided that the tumor was not sensitive to radiotherapy. The patient refused orbital exenteration, so I tried chemotherapy, which was administered exclusively for the treatment of leukemia at the time. We did not know the proper dosage amount or length of treatment time, but ultimately determined administration once a week for the first month, then once a month for two years. Forty years later, she is still in good health, but she kept me awake for nights.

What drives your passion for practicing? I love the relationship I have with my patients. I love ophthalmology and have been so fortunate to live during what I consider to be the golden years of ophthalmology. As a professor, I have thrived on the opportunity to mentor generations of young ophthalmologists. I began my career in orbital surgery, then focused on retinal and cataract surgery before concentrating on refractive surgery. My passion is to move toward the new and challenging fields in ophthalmology. ■

FAST FACTS

- Honorary Chair Professor at the Université Paris VII and Chairman of Ophthalmology at the Hôpital Robert Debre and Foundation Rothschild in Paris
- Holds the patent on the picosecond, ophthalmic Nd:YAG laser for cataract, vitreous, and corneal surgery
- 2003 Ophthalmology Hall of Fame inductee and 1987 ASCRS Innovator Lecturer
- Awarded the Chevalier de la Légion d'Honneur in 1983 by President Mitterand for the Nd:YAG laser
- Has had her paintings on display in recent art exibits