

**REFRACTIVE  
SURGERY****A beat beyond: pacemakers and lasers****by Maxine Lipner Senior EyeWorld Contributing Editor***Considering the effect of ophthalmic lasers on cardiac devices*

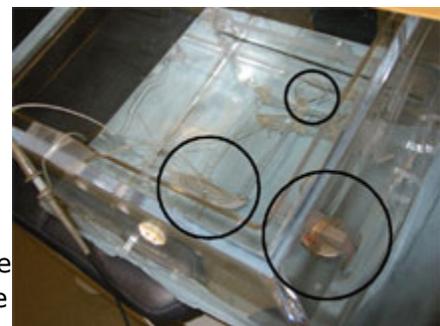
**I**t's a sign that commonly hangs on the wall of ophthalmic laser suites, maybe even your own: "Do not enter if you have a cardiac pacemaker or defibrillator." Such signs are enough to make patients and even some affected practitioners more than a little wary, but are their concerns warranted? Not likely if it is a modern device, according to Neal A. Sher, M.D., adjunct clinical professor of ophthalmology, University of Minnesota, Minneapolis. Dr. Sher, together with a member of his practice, Mikhail P. Golben, B.S. and Ramiro Barriga MSE, a Medtronic employee collaborator, recently completed a study evaluating just how safe the use of ophthalmic lasers is in the proximity of pacemakers.

Signs are typically posted due to worry about the electromagnetic field surrounding pacemakers and other electronic devices. "The chief concern is interference that would be interpreted as signals from the heart causing the pacemaker to [erroneously] react," Mr. Golben said.

Such an event could have serious repercussions. "The worst disaster that you could have is performing cataract surgery or some delicate procedure such as making a LASIK flap and the patient jumps because he or she had an aberrant shock," Dr. Sher said.

**Investigating interference**

With this in mind, he set out to investigate the effects of electromagnetic interference generated by ophthalmic laser systems on implantable pulse generators (Medtronic, Minneapolis) and implantable cardioverter defibrillators (Medtronic). While both devices are similar, monitoring function and relying on electrical pulses to pace the heart, the implantable cardioverter

**EnTrust implantable cardioverter defibrillator****EnRhythm implantable pulse generator****Simulated thoracic chamber with submerged EnRhythm IPG (circled, lower right); an exposed cardiac lead is also visible (circled, upper right), which will deliver pulses that**

defibrillators have added features. These can treat cardiac arrhythmias with the aid of high voltage therapies such as cardioversion defibrillation and anti-tachycardia pacing, according to Dr. Sher.

In the study, four ophthalmic laser systems were included: the Visx Star S4 excimer laser (Abbott Medical Optics, Santa Ana, Calif.), the Lumenis Selecta II 532 Nd: YAG laser (Santa Clara, Calif.), the Ellex Ultra Q Nd: YAG laser (Adelaide, Australia), and the Coherent Argon 30-SL-M laser (Santa Clara, Calif.). For the testing, simulated thoracic chambers were used. The pacemakers were submerged in saline to simulate the resistance around the heart. "We would then fire the laser in close proximity to this chamber and monitor what the pacemaker could detect or actually reacted to," Mr. Golben said. "The pacemaker doesn't react to everything it sees; it sees all the signals in the environment and then filters out what it realizes are not relevant."

The outcomes here boded well for the pacemakers. "We found that there were no adverse reactions, and there were no signals that were misinterpreted as signals from the heart," Mr. Golben said. "The signals [from the lasers] did show up as interference that was in the environment." There was no reaction from the pacemakers to these signals, however. "The pacemakers successfully diagnosed this interference as something that was irrelevant and more or less discarded it as far as its programming was concerned."

### **Testing additional devices**

Just recently Dr. Sher expanded the study to include cardiac pacing devices from St. Jude Medical (St. Paul, Minn.). "We did similar work on their implantable devices," he said. "We actually used a more sophisticated measuring technique."

All of the measurements on the St. Jude pacemakers were internal, according to Mr. Golben. "With the Medtronic pacemakers, we had an oscilloscope that measures the activity in the surrounding environment, and we used that to monitor what signals were present and what were being produced by the pacemaker," he said. "With the work that we reproduced with St. Jude Medical, we actually examined what the pacemaker itself saw."

Investigators found that the results were more or less the same here as in the earlier trial. "We could see laser pulses and interference," Mr. Golben said. "On the flip side, we could look at what the machine actually detected as an intrinsic signal, and it never reacted to anything."

He is buoyed by the results. "We've now reproduced this work several times and haven't had a single incidence of any adverse reactions," Mr. Golben said. Dr. Sher agrees. "We're gratified that these things are shielded as well



**Simulated thoracic chamber placed in patient position with a VISX Star S4 ophthalmic laser**

**Source: Neal A. Sher, M.D.**

as they are," Dr. Sher said. "There are often issues in going through airports with pacemakers, so you always worry."

Results suggest that for those who have modern pacemakers there is little risk. "We used the worst-case scenario with the highest energy levels, the most pulses, the widest beams, and the most sensitive settings on the pacers, and we didn't find any problems," Dr. Sher said. "So we think that in normal clinical practice this is not going to be a problem."

With this in mind, he urges laser centers to rethink warning signs regarding pacemakers. "I think that doctors should reevaluate the placement of these signs on laser suites because the sign creates anxiety among the patients and the surgeon," Dr. Sher said. "It creates unnecessary visits to cardiologists, and occasionally they've had to (temporarily) shut off pacemakers before surgery as well." The only caveat here may be with the use of cautery. "That could present a problem with these devices," he said. "We didn't look at and test this."

**Editors' note:** *Dr. Sher has financial interests with Medtronic (Minneapolis), but received no money from St. Jude (St. Paul, Minn.).*

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