LASER THERAPY'S NEUROREGENERATIVE INFLUENCE

(Adapted from June 2009 *PN/Paraplegia News* article)

When I was PVA's research director in the 1990s, a physical therapist excitedly told me how one of her patients with quadriplegia had regained impressive function after laser therapy (LT). She asked for my advice in moving her approach forward. Although I tried to be helpful, her paradigm-expanding, energy-based methodology just didn't fit into the prevailing thinking of the drug-emphasizing, biomedical establishment. Although the establishment supports meritorious approaches, it was not designed for quantum-leap innovations generated by outsiders. Because I now believe LT can exert substantial neuroregenerative influences, I regret I wasn't more proactive.

Lasers

Basically, lasers amplify light by producing coherent light beams. Because *low-energy* lasers represent a noninvasive, non-heat-producing, painless mechanism to stimulate regenerative processes, they are finding numerous therapeutic applications. Laser energy affects many physiological processes, including cellular respiration and gene expression.

Intriguing research documents LT's potential to treat various neurological injuries and insults, including peripheral-nerve, spinal-cord, and head injuries; and stroke. For example, research shows that laser irradiation induces sprouting and outgrowth of neurites (e.g., budding axons and dendrites), and stimulates the production of nerve growth factors.

Of special interest for SCI is LT's enhancement of functional recovery after stem-cell transplantation. Many SCI-focused transplantation programs are emerging throughout the world, and successful outcomes seem to be dependent on a host of factors; LT may be one of them.

Spinal-Cord & Peripheral Nerve Injuries

1) Israel's **Dr. Shimon Rochkind** believes that LT is best used to augment cell transplantation. For example, Rochkind's team examined the effects of combining the implantation of embryonic spinal-cord cells with LT on recovery after SCI in rats. Results indicated that the best recovery of limb function and gait performance, nerve-signal

conduction, and tissue growth occurred when cell implantation was combined with laser irradiation; i.e., each therapy by itself was less effective.

In another study, Rochkind evaluated the effects of laser irradiation on axonal regeneration across a transected *peripheral* nerve bridged with a biodegradable polymer. Such polymers may ultimately play an important role in SCI by paving over the pothole laden injury pathway to make it more regeneration friendly. Briefly, rats were irradiated at both the reconstructed peripheral injury location and the corresponding spinal-cord sections. Compared to controls, laser-treated rats had more myelinated (i.e. insulated) axons going across the polymer bridge, signal conduction, and functional recovery.

In another study, Rochkind evaluated LT's effectiveness in patients with incomplete peripheral-nerve or brachial-plexus-nerve injuries (nerve network that conducts signals from the spine to the arms). Specifically, 18 subjects, injured at least six months earlier, were randomly assigned to receive either transcutaneous laser irradiation or treatment from an identical looking placebo device. Subjects were treated for 21 consecutive days at the injury site and corresponding spinal-cord segments. Compared to controls, the laser-irradiated subjects improved in motor function.

2) **Drs. Kimberly Byrnes, Juanita Anders** and colleagues (Bethesda, MD) have shown that laser irradiation alters gene expression in rats after acute SCI and exerts an anti-inflammatory effect on the injured cord. These influences reduces secondary injury and, in turn, some of the barriers inhibiting axonal regeneration.

Especially relevant to the promising olfactory-tissue-transplantation procedures discussed recently (August & November 2008 *PN*), the investigators showed that laser irradiation alters gene expression of the regeneratively-endowed olfactory ensheathing cells (OECs). This alteration enhances the expression of key growth factors and extracellular-matrix proteins that support neuronal regeneration. The findings support LT's use in combination with OEC transplantation.

In a recent article, Dr. Anders et al compared the effects of LT in rats with injuries created by either

1) cutting a portion of the cord (i.e., hemisection) or

2) an impact-caused contusion (most common sort of injury). Immediately after injury, rats were irradiated through the skin at the injury site for 14 consecutive days. Compared to controls, LT augmented axonal survival and re-growth, and functional recovery for both injury types.

3) France's **Albert Bohbot** has developed a real-world program that combines LT with acupuncture, another therapy with function-restoring potential (www.laserponcture.eu). Although laser stimulation of acupuncture points is not new, Bohbot has refined the technology with a focus on treating a variety of neurological disorders, including SCI.

Key to his therapy is a network of acupuncture points that relate meridians (through which acupuncture's life-force qi energy flows) to dermatome levels (i.e., a region of skin sensation that corresponds to a specific spinal-cord area). Bohbot believes energy stimulation through this network promotes functional recovery.

He has treated numerous people with chronic SCI, many of which have regained impressive function. Bohbot's patients include those who have been recipients of transplanted regeneratively endowed cells or tissue, including OECs, patient-derived olfactory tissue, and bone-marrow-derived stem cells. (see resources below)

Stroke

Evidence indicates that LT improves outcomes after ischemic stroke (neurological damage caused by interruption of brain's blood flow). For example, in an international, multicenter clinical trial, 120 patients were randomized to receive transcranial LT (i.e., through the skull) or treatment from a sham device within 24 hours of stroke onset. After 90 days, 70% of the LT subjects had improvements compared to only 51% of the controls.

In a recent, even larger study, 660 patients with acute ischemic stroke were randomized to receive either transcranial LT or sham treatment. In the LT group, 120 achieved a favorable outcome compared to 101 controls.

Head Injury

Dr. A. Oron and colleagues (Israel) have shown that transcranial LT reduces head injury in rats when administered four hours after trauma. In an anecdotal case, a university teacher improved cognitive function after starting transcranial LT seven years after a head injury from an auto accident. Specifically, her ability to focus attention on her computer improved from ~20 minutes to three hours. However, she regresses if treatment is not maintained.

Conclusion

Ralph Waldo Emerson said "build a better mousetrap, and the world will beat a path to your door." Perhaps for many things - but when it comes to new therapies, it is more apropos to say the world may limp to your door sometime in the distant future. Preferring the status quo, the biomedical establishment is slow to embrace much needed innovation. Innovators are routinely slapped down and must pass through a daunting professional gauntlet to advance their ideas. This, indeed, has been the case for some of laser therapy's pioneers. Fortunately, a critical mass of new thinking has now percolated into the scientific community's collective consciousness - making it more difficult to dismiss the therapy's neuroregenerative potential.