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# Light Emitting Diodes Aid in Wound Healing

Powerful light-emitting diodes (LEDs) have been shown to help heal wounds in laboratory animals and are now being tested on humans at the Medical College of Wisconsin. The LEDs were developed by the National Aeronautics and Space Administration (NASA) to spur plant life in space.

**Harry T. Whelan, MD**, Professor of Neurology, Pediatrics, and Hyperbaric Medicine at the Medical College of Wisconsin, found that diabetic skin ulcers and other wounds in mice healed much faster when exposed to the special LEDs in the lab. Laboratory research has shown that the LEDs also grow human muscle and skin cells up to five times faster than normal. The study is conducted at the College's MACC (Midwest Athletes Against Childhood Cancer) Fund Research Center.

"For most wounds, we do not need to interfere with nature's healing," Dr. Whelan said. "But this technology may be the answer for problem wounds that are slow to heal."

The Food and Drug Administration has approved a multi-year investigation of the LEDs as an experimental treatment by a team led by Dr. Whelan. The study, funded by NASA, will specifically examine the technology's effects on diabetic skin ulcers, serious burns and flesh wounds caused by radiation and chemotherapy treatments. The studies on patients are being done at Children's Hospital of Wisconsin and Froedtert Hospital.

LEDs are being studied in comparison to and in conjunction with hyperbaric oxygen therapy, a standard treatment in which the patient is placed in a pressurized oxygen chamber to stimulate new cell growth.

In the first 18-month phase of the project, 100 individuals will be studied at Froedtert and Children's Hospitals. The participants have wounds such as a burn, crush injury, radiation burn, skin graft, diabetic ulcer, or any other wound with poor blood or oxygen supply, that is determined by their physician to be healing slowly or not at all.

In a separate protocol, Dr. Whelan is studying and using the LEDs to promote healing of acute mouth ulcers resulting from chemotherapy and radiation used to treat cancer in children. The treatment is quick and painless.

"Some children who probably would have to be fed intravenously because of the severe sores in their mouths have been able to eat solid food," said **David Margolis, MD**, Assistant Professor of Pediatrics and an oncologist at Children's Hospital, whose pediatric cancer patients are participating in the study. "Preventing this oral mucositis improves the patient's ability to eat and drink and also reduces the risk of infections in patients with compromised immune systems."

"So far, what we see in patients and what we see in laboratory cell cultures, all point to one conclusion," said Dr. Whelan. "The near-infrared light emitted by these LEDs seems to be perfect for increasing energy inside cells. This means whether you're on Earth in a hospital, working on a submarine under the sea, or on your way to Mars inside a spaceship, the LEDs boost energy to the cells and accelerate healing."

In another continuing study, Dr. Whelan has also used LED therapy to treat more than 20 individuals with brain cancer tumors without the side effects of traditional or laser surgery. This study, done in collaboration with **Glenn A. Meyer, MD**, Professor of Neurosurgery, uses LEDs to activate light-sensitive, cancer-killing drugs that can kill tumor cells beyond the surgeon's reach without harming healthy cells.

LED technology was developed to enhance the growth of plant tissue in space by NASA's Marshall Space Flight Center and Quantum Devices Inc. of Barneveld, Wisconsin. LEDs have a similar physiological effect on human cells as they do on plant cells. In space, the lack of gravity keeps cells from growing naturally, resulting in slow-growing plant life and loss of bone mass, atrophied muscles, and wounds that do not heal properly in astronauts. LEDs stimulate cytochromes in the body that increase the energy metabolism of cells. Cytochromes are part of the "electron transport chain" that converts sugar into instant energy required by the body to perform all of its actions, such as raising a finger or healing a wound.

Laser light has been shown to have similar effects on growing cells, but lasers are heavy, inefficient, more costly and do not offer the ideal wavelength of light for cell growth. The specially designed near-infrared LED has a longer wavelength than laser light that penetrates deeper -- to a depth of 23 centimeters, or more that nine inches -- without damaging the skin. Though three times brighter that the sun, the LED is very safe and easy to use, as well as portable. For wound healing, the LED is housed in a 3.5" by 4.5" flat array from which it emits a red light that is cool to the touch. An array of LEDs includes three wavelengths to affect various cell types.

An LED array is currently on board a US Navy nuclear submarine for treatment of potential training injuries. Dr. Whelan is a commander in the Navy and a diving medical officer for the Naval Special Warfare Command, which includes the SEAL (Sea, Air and Land) teams. Dr. Whelan has been inducted into the NASA Space Technology Hall of Fame for his research into the use of LEDs for wound healing and the treatment of brain tumors.

*For more information on this topic, see the HealthLink article Healing with Light Moves Beyond Fiction.*

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