

[NASA - National Aeronautics and Space Administration](#)

For release: 11-05-03

Release: 03-199

[Light emitting diodes bring relief to young cancer patients; NASA technology used for plant growth now in clinical trials](#)



Himelhoch, Medical Center Graphics Inc.)

A device using specialized light emitting diodes, based on NASA technology for plant growth in space, is continuing to show promise as a treatment to aid healing of bone marrow transplant patients. Use of the LED apparatus has advanced to the second phase of clinical trials in U.S. and foreign hospitals. Results from the first round of tests were highly encouraging, prompting researchers to expand the trials as they seek approval for the treatment as a standard of care for oral mucositis.

Photo: Light emitting diodes can ease pain and promote wound healing in bone marrow transplant patients. (NASA/MSFC/Barry

A nurse holds a strange-looking device, moving it slowly toward a young patient's face. The note-card-sized device is covered with glowing red lights, but as it comes closer, the youngster shows no fear. He's hopeful this painless procedure using an array of lights will help ease or prevent some of the pain and discomfort associated with cancer treatment.

The youngster is participating in the second phase of human clinical trials for this light healing device. The first round of tests by Medical College of Wisconsin researchers at Children's Hospital of Wisconsin in Milwaukee, was so encouraging that doctors have expanded the trials to several U.S. and foreign hospitals.

"We've already seen how using LEDs can improve a bone marrow transplant patient's quality of life," said Dr. Harry Whelan, professor of neurology, pediatrics and hyperbaric medicine at the Medical College of Wisconsin in Milwaukee. "These trials will hopefully help us take the next steps to provide this as a standard of care for this ailment."

The light is produced by light emitting diodes, or LEDs. They are used in hundreds of applications, from electronic clock displays to jumbo TV screens.

These LEDs provide light for plants grown on the Space Station as part of commercial experiments sponsored by industry under the Space Product Development Program at NASA's Marshall Space Flight Center in Huntsville, Ala. Researchers discovered that the diodes also had many promising medical applications, prompting this research to be funded by a NASA Small Business Innovation Research contract through the Technology Transfer Department at the Marshall Center.

Biologists have found that cells exposed to near-infrared light — that is, energy just outside the visible range — from LEDs grow 150 to 200 percent faster than those cells not stimulated by such light. The light arrays increase energy inside cells that speed up the healing process.

In the first stage of the study, use of the LEDs resulted in significant relief to pediatric bone marrow transplant patients suffering the ravages of oral mucositis, a common side effect of chemotherapy and radiation treatments according to Dr. David Margolis, associate professor of pediatrics at the Medical College. He works with Dr. Whelan on the study at Children's Hospital of Wisconsin, a major teaching affiliate of the Medical College.

Many times young bone marrow transplant recipients contract this condition that produces ulcerations in the mouth and throat, severe pain, and in some cases, inflammation of the entire gastro-intestinal tract. Swelling and bleeding occur, and chewing and swallowing become difficult, if not impossible — affecting a child's overall health because of reduced drinking and eating.

"Our first study was very encouraging, and using the LED device greatly reduced or prevented the mucositis problem, which is so painful and devastating to these children," said Whelan. "But we still need to learn more. We're conducting further clinical trials with larger groups and expanded control groups, as required by the U.S. Food and Drug Administration, before the device can be approved and available for widespread use."

The clinical trials are expected to take approximately three years with a total of 80 patients. Participants currently include the Medical College of Wisconsin in Milwaukee; Roswell Park Cancer Institute in Buffalo, N.Y. and Instituto de Oncologia Pediatrica, in Sao Paulo, Brazil. Rush-Presbyterian-St. Luke's Medical Center in Chicago; University of Illinois Medical Center in Chicago; Hospital Sirio Libanes in Sao Paulo Brazil; and Hadassah University Medical Center in Jerusalem, Israel have also asked to join the multi-center study.

In the first clinical study, the team examined each patient's mouth, tongue and throat. They asked the patient to rate the current level of pain before treatment. Each patient received one minute of LED therapy starting the day of the bone marrow transplant and a one-minute treatment each day thereafter for a two-week period.

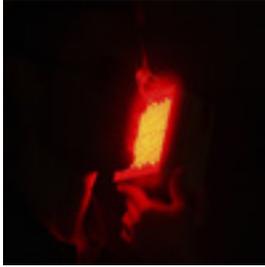
The treatment device was a 3-by-5-inch portable, flat array of light-emitting diodes. It was held on the outside of a patient's left cheek for just over a minute each day. The process was repeated over the patient's right cheek, but with foil placed between the LED array and the patient to provide a sham treatment for comparison. There wasn't any treatment of the throat area, which provided the control for the first study.

The researchers compared the percentage of patients with ulcerative oral mucositis to historical epidemiological controls. Just 53 percent of the treated patients in the bone marrow transplant group developed mucositis, considerably less than the usual rate of 70-90 percent. Patients also reported pain reduction in their mouths when compared to untreated pain seven days following bone marrow transplant.

Quantum Devices of Barneveld, Wis., makes the wound-healing LED device. The company specializes in the manufacture of silicon photodiodes — semiconductor devices used for light detection — and light emitting diodes for commercial, industrial and medical applications.

For release: 11-13-03
Photo release #: 03-199

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[Large](#) 1712 x 1368 (300)
[Medium](#) 500 x 400 (72)
[Thumbnail](#) 100 x 100 (72)

Healing power of light. Glowing red light emitted by light-emitting diodes or LEDs has been used to grow plants on NASA's Space Shuttle. Researchers at the Medical College of Wisconsin in Milwaukee, Children's Hospital of Wisconsin in Milwaukee and several other U.S. and foreign hospitals are using this near-infrared light, now in the second phase of clinical trials, to promote wound healing. (NASA/MSFC photo by B. Himelhoch, Medical

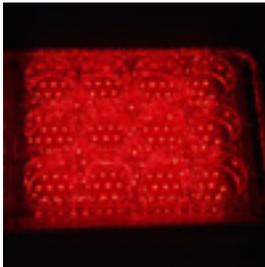
Center Graphics Inc.)



[Large](#) 1712 x 1368 (300)
[Medium](#) 500 x 400 (72)
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Wound healing device. The wound-healing device made by Quantum Devices Inc. in Barneveld, Wis., is a small 3.5-inch by 4.5-inch (90 by 145-millimeter) portable, flat array of light-emitting diodes, or LEDs. A nurse practitioner places the LED array on the outside of a patient's cheek where it shines for just over a minute each day, promoting wound healing and preventing mouth sores caused by radiation and chemotherapy. Quantum

Devices, the Medical College of Wisconsin in Milwaukee, and researchers at Children's Hospital of Wisconsin in Milwaukee are conducting the multi-year project through a contract with the Technology Transfer Department at NASA's Marshall Space Flight Center in Huntsville, Ala. (NASA/MSFC photo by B. Himelhoch, Medical Center Graphics Inc.)



[Large](#) 1712 x 1368 (300)
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Light-emitting diodes promote cell growth. Skin, bone and muscle cells grown in cultures are exposed to the same light-emitting diodes used to treat wounds in patients and grow plants in space. Biologists at the Medical College of Wisconsin in Milwaukee have shown that cells exposed to the near-infrared light grow 150 to 200 percent faster than ground control cells not stimulated by the light. Through a research project funded by

NASA's Marshall Space Flight Center in Huntsville, Ala., scientists are trying to learn more about the way cells convert light to energy and identify the wavelengths of light that are most effective at stimulating growth. (NASA/MSFC photo by B. Himelhoch, Medical Center Graphics Inc.)



[Large](#) 1280 x 960 (300)

[Medium](#) 500 x 375 (72)

[Thumbnail](#) 100 x 100 (72)

Three types of red light. Ellen Buchmann, a molecular biologist at the Medical College of Wisconsin in Milwaukee, is conducting research to investigate how infrared energy from light-emitting diodes influences the growth of cells. Doctors are examining how this infrared energy promotes wound healing. Three rows of glowing light-emitting diodes release energy at specific wavelengths. Different cells, such as skin, bone and muscle cells, respond differently to various wavelengths or energy levels of light. The light can penetrate tissue to a depth of up to 9 inches (23 centimeters). Quantum Devices Inc., of Barneveld, Wis., manufactures the light-emitting diode units as part of a contract through the Technology Transfer Department at NASA's Marshall Space Flight Center in Huntsville, Ala. (NASA/MSFC/T. McMahan)

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