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NASA Light Technology Successfully Reduces Cancer Patients Painful Side Effects from Radiation and Chemotherapy 03.03.11

A NASA technology originally developed for plant growth experiments on space shuttle missions has successfully reduced the painful side effects resulting from chemotherapy and radiation treatment in bone marrow and stem cell transplant patients.

In a two-year clinical trial, cancer patients undergoing bone marrow or stem cell transplants were given a far red/near infrared Light Emitting Diode treatment called High Emissivity Aluminiferous Luminescent Substrate, or HEALS, to treat oral mucositis -- a common and extremely painful side effect of chemotherapy and radiation treatment. The trial concluded that there is a 96 percent chance that the improvement in pain of those in the high-risk patient group was the result of the HEALS treatment.

"Using this technology as a healing agent was phenomenal," said Dr. Donna Salzman, clinical trial principal investigator and director of clinical services and education at the Bone Marrow Transplant and Cellular Therapy Unit at the University of Alabama at Birmingham Hospital. "The HEALS device was well tolerated with no adverse affects to our bone marrow and stem cell transplant patients."

The HEALS device, known as the WARP 75 light delivery system, can provide a cost-effective therapy since the device itself is less expensive than a day at the hospital and a proactive therapy for symptoms of mucositis that are currently difficult to treat without additional, negative side effects.

The device could offer patients several benefits: better nutrition since eating can be difficult with painful mouth and throat sores; less narcotic use to treat mouth and throat pain; and an increase in patient morale -- all of which can contribute to shorter hospital stays and less potential for infection, added Salzman.

LEDs are light sources releasing energy in the form of photons. They release long wavelengths of light that stimulate cells to aid in healing. HEALS technology allows LED chips to function at their maximum irradiancy without emitting heat.

NASA is interested in using HEALS technology for medical uses to improve healing in space and for long-term human spaceflight.

Ron Ignatius, founder and chairman of Quantum Devices Inc., of Barneveld Wis., developed the WARP 75 light delivery system for use in the trial. The device uses the HEALS technology to provide intense light energy: the equivalent light energy of 12 suns from each of the 288 LED chips -- each the size of a grain of salt. It is one of many devices using HEALS technology, developed in collaboration with NASA.

In the early 1990s, Quantum teamed with the Wisconsin Center for Space Automation and Robotics -- a NASA-sponsored research center at the University of Wisconsin-Madison -- to develop Astroculture 3, a plant growth chamber using near infrared HEALS technology for plant growth experiments on shuttle missions. Over the years, Quantum has worked to develop HEALS technology for use in medical fields, specifically with pediatric brain tumors and hard-to-heal wounds such as diabetic skin ulcers, serious burns and oral mucositis.

"With the help of NASA's Innovative Partnerships Program, Quantum Devices and its medical partners have been able to take a space technology and adapt it for an entirely different application to significantly help people here on Earth," said Glenn Ignatius, president of Quantum Devices. "This collaboration between NASA and commercial companies has spurred innovation that is touching millions of lives on Earth -- for the better."

Watch a short video about HEALS in action:



Glowing red light from High Emissivity Aluminiferous Luminescent Substrate, or HEALS technology has been proven to aid in the healing of human wounds, burns, diabetic skin ulcers and oral mucositis. (NASA/MSFC/Higginbotham)



A nurse in the Bone Marrow Transplant and Cellular Therapy Unit at the University of Alabama at Birmingham Hospital demonstrates use of a WARP 75 device. (NASA/MSFC/Higginbotham) [View all images](#)

The clinical trial was funded by NASA's Innovative Partnerships Program at the Marshall Space Flight Center in Huntsville, Ala. It included 20 cancer patients from Children's Hospital of Wisconsin and 60 cancer patients from the University of Alabama at Birmingham Hospital and the Children's Hospital of Alabama, also in Birmingham. The trial was the brainchild of Brian Hodgson, DDS, a pediatric dentist at Marquette University and Children's Hospital of Wisconsin – both in Milwaukee, Wis. Dr. Harry T. Whelan, Bleser Professor of Neurology at the Medical College of Wisconsin, served as the clinical trial principal investigator at Medical College of Wisconsin and Children's Hospital of Wisconsin.

Patients participated in the multi-center, double-blind, placebo-controlled research study – a way of testing a medical therapy where some groups receive treatment and others receive a placebo treatment that is designed to have no real effect. Participants were randomly placed in one of four study groups: low- and high-risk patients receiving the experimental light therapy through the WARP 75 device, and other low- and high-risk patients receiving light through a similar device without therapeutic effects. The low-risk patients were those whose chemotherapy and radiation treatment tended to cause mild or no mucositis and the high-risk patients were those whose therapy treatment tended to cause severe cases of mucositis.

Patients received the light therapy by a nurse holding the WARP 75 device -- about the size of an adult human hand – in close proximity to the outside of the patient's left and right cheek and neck area for 88 seconds each, daily for 14 days at the start of the patient's bone marrow or stem cell transplant. During that time, trained clinicians assessed the patient's mouth and patients completed a simple form to indicate their level of pain.

"NASA is proud to be a part of the HEALS technology medical advancements that are improving the lives of cancer patients and providing new, innovative medical applications," said Helen Stinson, technical monitor for the NASA HEALS contract. "It's exciting to see the spinoffs from NASA's science and technology initiatives continually improve the quality of life for people here on Earth."

The WARP 75 device is currently undergoing Food and Drug Administration premarket approval.

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Page Last Updated: March 14, 2011
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