A perfect bond

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Not much has changed in the last 2,000 years when it comes to suturing together cuts and wounds. Even with microsurgery techniques, infection and permanent scarring remain major concerns. To minimize these dangers, doctors tried using a carbon dioxide laser to seal wounds, but without the ability to control the heat of the laser, the technique created even greater risks. Until now.

Using carbon dioxide lasers to seal wounds inside the body and out with a technique known as "laser welding," a team of Tel Aviv University researchers have perfected a new device to heat body tissue in a precisely controlled manner. The work of the research team, headed by Prof. Abraham Katzir from TAU's Applied Physics Group, could change the way surgeons bond cuts on the surface of our skin and inside our bodies during surgery.

With the new device, if the laser begins to overheat and risks burning the tissue, laser power is reduced, and if the temperature is too low to complete a closure, laser power in increased appropriately.

Getting the Temperature Just Right

Earlier attempts to use carbon dioxide lasers for bonding of cuts in the operating room or in clinics were not very successful. Causing thermal damage, the lasers either "undercooked" or "overcooked" the patient's delicate tissues.

Prof. Katzir set out to find the right temperature for optimal wound

healing, and to perfect a device that could maintain this temperature. He is the first to apply the carbon dioxide laser, coupled to optical fibers, for wound closure under a tight temperature control. His innovation is in the use of unique optical fibers made from silver halide developed at Tel Aviv University. The fibers deliver the laser's energy to heat the bonded cut and are used for controlling the temperature. They also make it possible to bond tissues inside the body.

"Sutures or stitches are not water tight, and blood or urine can pass through cuts, causing severe infection," he says. "Also, in many cases, a surgeon needs great skill to perform internal stitching, or in bonding tiny blood vessels, or in mending cuts on the skin so there will be no trace left on the body."

Inside and Out

Prof. Katzir and his colleagues have carried out successful clinical trials on people undergoing gall bladder removal surgery. At the close of the surgery, four cuts were left on the skin of the abdomen, two of which were sutured and two laser-bonded. The results of the trials suggest that the laser-bonded tissues heal faster, with less scarring.

Successful preliminary experiments demonstrated that the new technique can be used to bond cuts on the cornea, bladder, intestines, blood vessels or trachea. It may also be used for bonding tissues inside the body on organs such as the kidney, and even in brain surgery. Perfect for healing soft tissues, the laser may prevent an enormous amount of trauma when used for closing internal wounds.

Heading for the FDA

Working with the permission of Israel's Ministry of Health, the team will

soon be treating longer cuts, such as in the case of hernia operations, and is expected to apply to the FDA in the U.S. for larger-scale trials. If successful in these larger tests, the basic research could be developed into a commercial product within a few years.

"We think plastic surgeons will especially love this invention. Bonding tissues that heal well without scarring is a true art that few people possess," says Prof. Katzir. This method, he says, will be much easier to master than suturing and will generate a watertight bond, preventing infections and accelerating healing.

"It could also become a device for the battlefield, allowing soldiers to heal each other on contact with a laser wand," says Prof. Katzir, who currently holds the Carol and Mel Taub Chair in Applied Medical Physics in the School of Physics and Astronomy at Tel Aviv University.

Source: American Friends of Tel Aviv University