Design World
HABANERO RELEASE

ARTICLES

Motion Control System Helps Doctors Trim the Fat

by Design World Staff
Friday, July 11, 2008

The number of elective procedures performed in cosmetic surgery grows every year. Many of these procedures cannot be automated. Parts of Liposuction surgery, however, can be. This surgical procedure is one of the fastest growing segments in the cosmetic surgery field. Both men and women opt for it. In 2007, more than 700,000 people had this surgery. This growth has driven the need to change how the actual operation is performed.

The Airbrush LiposculptureTM Intellimotion System consists of a small table-top controller and reciprocating cannula hand piece. The hand piece uses dual small air cylinders sequenced by the motion controller. Through a dual cannula arrangement, a smaller diameter cannula tube slides inside a larger diameter outer cannula.

The typical liposuction system incorporates a stainless steel cannula hand piece connected to a vacuum pump. The doctor removes fat from a patient by inserting the cannula into the fat tissue and uses short, fast, back and forth movements to remove the excess tissue. This procedure involves quite a bit more physical labor for the doctor than is typical of other medical procedures. A typical two-hour operation at 150 strokes per minute requires 18,000 arm movements, or the equivalent to vacuuming about 1800 steps! If the doctor has to use all his or her strength to perform the procedure, they may not be able to focus as much as they would like on smooth and even fat removal. But with the right equipment a doctor can provide improved results for their patients and far less physical labor from themselves.

As head of BioSculpture Technology, plastic surgeon Dr. Robert Cucin set out to develop a system that was easier on the doctor and easier on the patient with less tissue trauma and faster recovery time, while also costing less.

After years of research, Dr. Cucin and his team designed the Airbrush LiposculptureTM Intellimotion System. The new system gives the doctor better control while reducing physical effort, and improves results to the patient.

After reviewing a number of possibilities, the Biosculpture Technology design team came up with an automated system that a doctor can precisely control for easier and more effective lipo surgery using motioncontrol technology.

The Airbrush LiposculptureTM Intellimotion System consists of a small table-top controller and reciprocating cannula hand piece. At the heart of the system is a motion controller with resident programming to store and run multiple programs. The system needed 24 V outputs to directly drive pneumatic valves. An LCD display is used to set and read system parameters. Analog inputs handle rate and stroke adjustments along with position feedback.

Because there is little space available in an operating room, the table-top Intellimotion control unit occupies the same area as a piece of paper.

Size was a concern as real estate is at a premium in the operating room. Controls Company Trio Motion Technology was contracted to design a motion controller to meet all the requirements for the new system. The compact table-top Intellimotion control unit occupies the same area as a piece of paper.

With the controller portion in place, the next challenge was to design an automated hand piece. The hand piece would replace a doctor's back and forth motion to reduce physical effort during surgery. Pneumatic components were chosen for a safe and easy way to produce the needed force.

The hand piece uses dual small air cylinders sequenced by the motion controller. The instrument that enters the patient is a patented dual cannula arrangement where a smaller diameter cannula tube slides inside a larger diameter outer cannula. The outer tube diameter is 0.25 in. with a maximum stroke of 2.00 in. The inner cannula attaches to the carriage in the hand piece and is pushed back and forth by the dual air valves. A linear potentiometer mounted in the hand piece provides cannula position feedback. A push-push algorithm programmed in the motion controller is used on the valves with a cushion adjustment to help soften the motion making it more comfortable to hold.

In addition to reducing the physical exertion required by the surgeon, the Airbrush LiposculptureTM system allows the doctor to continually adapt the speed and stroke of the cannula for better control and more favorable results; the twin cannula system reduces tissue trauma and reduces bleeding, bruising, and swelling.