

Advanced Osteotomy Tools - AOT

Developed the unprecedented cold ablation robot-guided laser osteotome system: **CARLO®**

www.aot.swiss

Advanced Osteotomy Tools AG - AOT
Wallstrasse 6
4051 Basel
Switzerland

Founded in:	December 2010
CEO:	Cyrill Bättscher
No. of employees:	25
Type of Ownership:	private
Primary stock exchange:	N/A

November 2019: Founded by four experts in laser physics, medical image analysis, and cranio-maxillofacial surgery AOT is reinventing the bone surgery field with laser osteotomy technology: **CARLO®** (Cold Ablation Robot-guided Laser Osteotome).
Venture Valuation (VV) interviewed, Cyrill Bättscher, CEO.



VV: **This year, CARLO® carried out the world's first successful corrective surgery of the upper jaw at the University Hospital Basel. How does CARLO® work?**

Bättscher: CARLO® consists of a tactile robotic arm (see photo), a solid state photoablation laser source mounted on the distal end of the robot arm, a navigation system and a computer console to control the photoablation laser source, with a closed loop control system to stop the laser source sending laser pulses when a bone is fully traversed.



CARLO® allows surgeons to perform osteotomies with maximum precision and patient specific configurations based on CT (computer tomography) data. Surgeons have full control of the procedure while being assisted with a simple and intuitive 3D planning, navigation and control software and hardware which allow for preoperative planning but also intraoperative ad-hoc changes.

By applying short laser pulses, cold ablation cuts can be achieved, resulting in a surgically clean and highly open porous cut unobstructed the blood flow for quick bone healing. The bone tissue in the area of the laser cutting surfaces is left intact and vital.



If anything unanticipated happens during surgery, for instance, the patient slightly moves on the operation table, CARLO® stops straightaway with the speed of light.

At present CARLO® is capable of cutting bone up to 20 mm. We are currently working on improving the cutting ability to over 50 mm.

VV: What are major advantages of using CARLO® over currently available methods?

Bätscher: First, CARLO® provides accuracy and freely selectable design cuts. Right now, hard tissue applications using laser systems are mostly conducted manually. Operating by hand and achieving the required accuracy, to fit for example a patient specific implant, even by experienced surgeons, is a challenging task.

Second, faster healing: the bone does not overheat and its microstructure is kept intact and viable. The result is better vascularization and faster healing compared to conventional surgical procedures that cause microstructural damage, carbonization and smear layers at the cutting interface.

Third, less invasive surgery: functional bone cuts can be made to allow for new and less invasive procedures. This means that the patient's physical and psychological burdens could be alleviated, and that medical costs would decrease as not more physical bone cutting instruments are necessary.

And finally, shorter operation time: I am convinced that new operative techniques will arise from the capabilities CARLO® has to offer.

In conjunction with CARLO®, we are developing real-time tissue analysis based on the LIBS (Light Induced Breakdown Spectroscopy) technique. This will be a great help for surgeons to find out if they are operating on healthy or cancerous tissue in the operating room.

VV: AOT is transitioning into a market driven stage from the technology driven phase. Your current focus is to obtain the CE mark and then FDA approval by working with your network of surgeons and hospitals in Europe, the U.S., and internationally.

Bätscher: For CE marking, the required clinical studies are being conducted in major hospitals in Europe. Several initial cases have been successfully completed in collaboration with the University Hospital Basel (Switzerland), and the Vienna Hospital (Austria). FDA approval will be pursued.



With the intellectual property (11 family patents) well protected, we are proactively exploring collaborations, partnerships, investment opportunities worldwide.

VV Comments after the interview:

According to the most recent report published in September 2019 by Global Market Insights¹, the global surgical robot market is expected to grow to 24 billion USD by 2025.

Currently, the general approach to robotic surgery is to use small tools attached to a robotic arm. The surgeon controls the robotic arm with a computer. CARLO® will lead the next generation robotic bone surgery by performing interventions contactless. By processing several hundred megabytes of data per second, CARLO® makes its own decisions based on sensor data. This process is a further step beyond the well-known Da Vinci surgical robot that simply follows a surgeon's instructions.

The world's elderly population is growing considerably. The higher life expectancy becomes, the more bone injuries will occur due to the often frail physical conditions of the elderly. Innovative tools such as CARLO® offering faster healing and less invasive procedures than conventional osteotomy will change the landscape of the bone surgery field.

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¹ Roboticsandautomationnews.com 2019/09/02