



University
of Basel

Department of
Biomedical Engineering

The MIRACLE Project: Cutting bones minimally invasive with laser light



Robotic endoscope for minimal invasive laser surgery of bone
(picture: F. Brüderli)

The flagship project MIRACLE develops a minimally invasive laser osteotome: A flexible endoscope that enables cutting bones with laser light through small incisions and thus contact-free bone surgery. The interdisciplinary research team is headed by Prof. Philippe Cattin and Prof. Hans-Florian Zeilhofer. It is funded with CHF 15.2 million by the Werner Siemens-Foundation.

Laserosteotomy offers several advantages over conventional mechanical bone surgery such as accurate cuts, functional cut geometries and accelerated healing due to less trauma. MIRACLE, short for Minimally Invasive Robot-Assisted Computer-guided LaserosteotomE, aims for its application within a diverse range of fields, including orthopaedics, neurosurgery, traumatology, and spinal column surgery. Four research groups were established at the Department of Biomedical Engineering to achieve the miracle of minimally invasive bone surgery:

- The **Planning and Navigation Group** creates the Virtual Reality environment.
- The **Bio-Inspired Robots for MEDicine-Lab** develops bio-inspired robotic and mechatronic systems for medical applications.
- The **Biomedical Laser and Optics Group** develops laser- and optical-based systems for medical applications.
- The **Smart Implants Group** develops a novel Minimal-Invasive Modular Implant System.



MIRACLE team (picture: T. Schürch)

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