



## Detecting early cartilage damage.



### Osteoarthritis: A serious disease

Osteoarthritis is a joint disease resulting from the breakdown of joint cartilage and underlying bone. It contributes to the global disability and affects an estimated 242 million people worldwide. A large part of this population is senior, which is highly susceptible to bone diseases that will substantially drive the demand for these devices.<sup>1</sup>

### MIRACLE device solution

MIRACLE is the first mid-infrared attenuated total reflection (MIR-ATR) arthroscopy system for real-time, in-depth, clinical examination and diagnosis of degenerative joint diseases, that can be used in clinical cases where patients are recommended to undergo arthroscopy surgery.

### Promoting patient well-being

MIRACLE device will allow orthopaedic surgeons to obtain real-time information about the biochemical composition of the cartilage tissue, leading to objective decision-making on the most adequate treatment course, enhancing patient's well-being and reducing the need for follow-up surgery.

### Facts on Osteoarthritis



**242 million**  
people affected globally



**50%**  
over 65 affected worldwide



**8.9 years**  
estimated delay for diagnosis



up to  
**€10,452**  
per year / patient in EU

<sup>1</sup> - March et al. Osteoarthritis: A Serious Disease: Submitted to the U.S. Food and Drug Administration. 2016

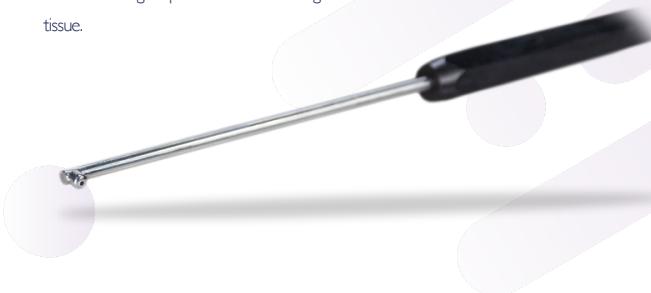


This project received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 780598. The project is an initiative of the Photonics Public Private Partnership.

## Empowering surgery practice to promote patient well-being

The concept behind MIRACLE is quite simple. Cartilage tissue is made of very specific molecules. Some molecules have particular response when illuminated with a specific light source (as for example specific lasers). This phenomenon is called molecular vibration and it can generate a frequency spectrum, which works as a molecular 'finger print' for the cartilage tissue.

Healthy and damaged cartilage have different spectra. Also, different damage levels show different spectra. Based on these scientific evidences, MIRACLE device will be capable of compiling this information into a colour-coded map of healthy and damaged tissue during the arthroscopy procedure.



The surgeon will then have all detailed information in a graphical user interface to decide whether further action has to be taken. The device is not capable of doing external examination and will be used only during arthroscopy.

### How does it work?



The Quantum Cascade Lasers (QCL) with clinically relevant wavelengths to assess the articular cartilage biochemical composition are effectively coupled to the MIR-ATR probe through a unique integrated beam combiner (iBEAM). All the components are integrated within a main unit. The innovative hook-like shaped MIR-ATR probe acquires the MIR spectra from the superficial layer of the articular cartilage and the collected data are then integrated into a clear and simple software interface that ensures real-time interpretation of cartilage quality.

### Consortium

