BioOptico

Change your view on surgery

Treatment
- Easier to decide
- Back up your decisions
- Easier to follow-up
- Better result for patients

New ways of communicating with
- Patient
- Insurance company
- Authorities
- Colleagues and in research

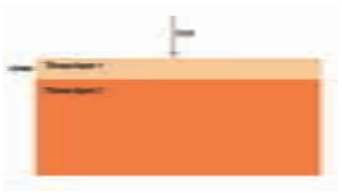
Background

Articular cartilage lesions are commonly encountered by the orthopedic surgeon. Retrospective studies show that **cartilage lesions are seen in 60 - 65% of knee arthroscopies**. It is well known that cartilage lesions have poor intrinsic capability for healing. Options exist for the treatment of cartilage lesions, including bone marrow stimulation, tissue based and cell based therapies. As cartilage lesions are **poorly visualized using radiography or magnetic resonance imaging**, cartilage repair strategies are normally established arthroscopically, including visual inspection and probing of the cartilage surface.

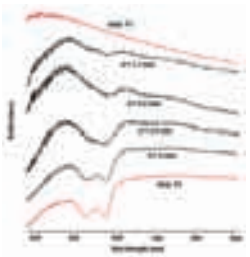
There is no clear consensus in the field of cartilage repair. Patient groups are largely inhomogeneous and there are no mechanisms using arthroscopic techniques to make quantifiable assessments of articular damage to assist the surgeon. Double-blind studies for cartilage repair strategies are therefore rare and often not feasible. At the same time, the need for physicians to document their outcomes and to justify the cost of new technology is constantly increasing. Pressure arises primarily when communicating with patients, hospitals and in reimbursement situations. **Today, the surgeons must rely on previous treatment results and on experience.**

To assist the physician in these issues, BioOptico has developed a cartilage lesion grading (CLG) system for use during arthroscopy. The CLG technology is based on **software filters in combination with mathematical algorithms**, and can provide both live video sequences and still images with enhanced contrast between intact cartilage and the lesions. Furthermore, quantitative parameters that describe the lesion and/or lesion treatment results are provided. We believe that this technology can **significantly improve clinical practice** in both initial and follow up situations.

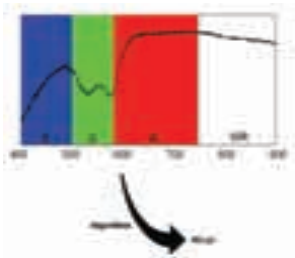
Innovative image systems for endoscopy



The BioOptico technology is applicable in situations where layered biological material is present. Typical endoscopy applications are arthroscopy, where the joint cartilage covers the subchondral bone, and coloscopy, with the different layers of the intestinal wall.

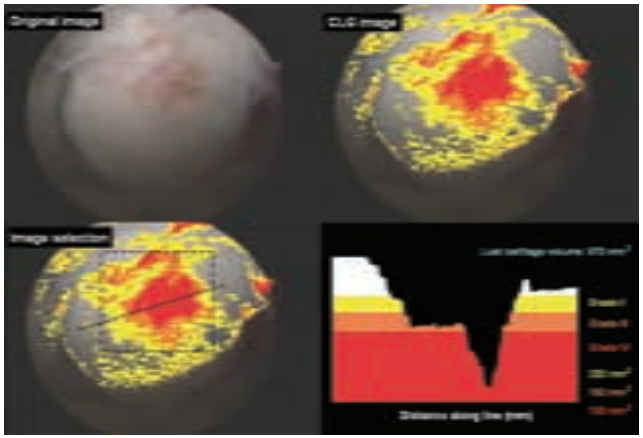


A reflectance spectrum taken at point (x,y) from the layered tissue surface will vary in shape according to tissue layer 1 (T1) thickness (d). Visible wavelengths penetrate biological tissues to a depth of 1 – 3 mm.



By applying a mathematical algorithm based on the spectral differences between the red, green and blue pixel values of a commercial endoscopy camera, tissue layer 1 thickness at point (x,y) can be derived from the pixel values at (x,y). Most cameras also give information in the near-infrared wavelength range to further increase the accuracy of the calculations.

By repeating the algorithm calculations pixel by pixel and frame by frame, a 2D map of tissue layer 1 thickness can be encoded in real-time video on the monitor of the endoscopy system. Advantages include enhancing boundaries between intact and damaged tissue and calculating depth and size of damaged regions.



BioOptico's cartilage lesion grading system for arthroscopy.

Competitors

Techniques similar to the contrast enhancement part of BioOptico's technology are seen in other endoscopy applications, primarily Olympus' **NBI technology** and Fujinon's **FICE technology**, both used for enhancing vessel structures in gastro-intestinal endoscopic images.

The primary non-invasive alternative to arthroscopy is **magnetic resonance imaging (MRI)**. In contrast to arthroscopy, MRI is a pure diagnostic technique. Image resolution is also too low for grading cartilage lesions.

Clinical validation

BioOptico's technology is currently being evaluated together with **RJAH Orthopaedic & District Hospital in Oswestry**, UK.

The technology also has a significant role in veterinary arthroscopy. Here, BioOptico is working with the **Regional Animal Hospital in Helsingborg**.

The Company and operational plan

BioOptico was founded in 2005 by **researchers at Linköping University**. BioOptico's main innovation is a spectral analysis method for interpretation of arthroscopic images. BioOptico has **patents pending regarding the method** and developments that can extend the technology into other areas of endoscopy.

The technology makes cartilage thickness measurements possible, directly via the arthroscopic image, and it enhances regions in the image with worn or damaged cartilage. Important **markets are seen both within human and veterinary care**, specifically in connection with **joint trauma and osteoarthritis** assessments.

BioOptico is at the moment **establishing an exclusive commercial collaboration** with an arthroscopy manufacturer to integrate the CLG product within existing equipment. Great interest has been shown by the leading arthroscopy manufacturers on the market.

BioOptico is currently working with a number of future products for **other endoscopy applications**.

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