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Coherence-Gated Doppler

Summary

Coherence Gated Doppler (CGD) is an optical fiber sensor technology to measure blood flow in restricted or difficult to reach locations by combining the strengths of two optical technologies, the laser Doppler flowmetry (LDF) and the optical coherence tomography (OCT). Initial studies have focused on dental applications.

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Field
Dental, Surgery

Technology
Surgical device

Technology Status
Prototype developed - testing

Status
Available for licensing
Available for sponsored research

Patent Status
US patent 9,486,140 issued 11/8/2016

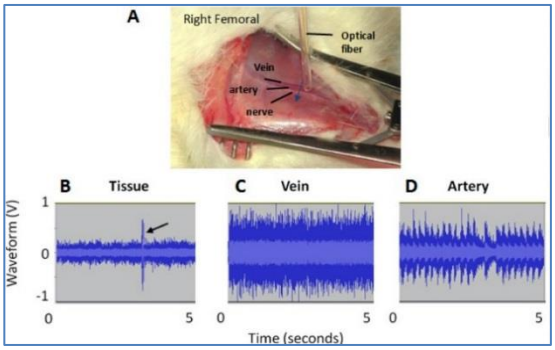
UMB Docket Reference
CT-2013-008

External Reference
Biomed Opt Express. 2013 Apr 24;4(5): 760-71.

Market

One important application for the CGD device is the detection of tooth vitality during routine dental procedures, best determined by the presence or absence of blood flow within the root of a tooth. The target market for the CGD device are the nearly 200,000 dentist offices that perform crown and filling procedures and the ~15 million endodontic procedures performed each year. Current methods rely on the sensitivity of pulpal nerves to thermal/electrical stimuli, which is unreliable. The practice of passive monitoring for changes in the tooth can result in inflammatory root reabsorption, loss of the tooth, and need for bone graft before any subsequent implant procedure. The CGD device addresses current deficiencies in endodontic diagnosis by reliable and non-invasive means to determine tooth viability, identify cases with irreversible pulpal pathology and prevent the development of acute dental emergencies.

Technology



The CGD is a hybrid of two optical technologies with an audio output similar to that of Doppler, but optimized to detect an intermediate size region. The current LDF technology remains highly sensitive but suboptimal for localization of flow signals while the OCT and its Doppler variant, DOCT, has confocal capability but lacks an effective detection zone limiting its ability to detect weak signals. The CGD enables highly sensitive detection within a localized region of interest. The CGD technology is applicable for use in detection and quantification of flow in the vessels of living tissue utilizing a sensor probe. Current proof-of-concept studies are ongoing for the detection of blood flow in the root of teeth to assess tooth vitality. Other applications may be used in conjunction with catheters and needles within the medical field. Additional advantages of the CGD include simpler operation, small size, and increased durability than either of its parent technologies. These characteristics endow the CGD with the ability to serve multiple biomedical applications. (e.g. real-time guidance in interventional radiology and minimally invasive surgery)

Advantages

- *In dentistry*: Non-invasive measurement of tooth pulp vitality
- Blood vessel detection during "blind" medical interventions
- Determination and measurement of flow at the sensor tip

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