Biomedical imaging with Optical Coherence Tomography. Systems and applications

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Abstract

We present an overview of our most recent researches in Optical Coherence Tomography (OCT) imaging [1-3], with applications in the biomedical field. Handheld scanning probes with galvanometer-based scaners (GSs) have been developed, both with uni-dimensional (1D) [4, 5] and with bi-dimensional (2D) GSs [6]. Such GSs have been optimized for OCT, in order to obtain the maximum possible duty cycle/time efficiency of the scanning process [7], minimum distortions in OCT images [8], as well as algorithms to collate individual OCT images in order to obtin compound images, corresponding to a large field-of-view [9] – all these taking into account the main scanning parameters: input duty cycle, scan frequency, and scan amplitude, therefore applicable not only for GSs, but for any type of laser scanner with oscillatory mirrors. This expertise has thus also been used to optimize OCT scanning using Micro-Electro-Mechanical Systems (MEMS) [10]. Optimal, non-distorted, real time, *in vivo* images can thus be obtained using a variety of scanning engines – as a step forward from previous studies that had to employ post-processing of images (when using sinusoidal scanning with MEMS, for example [11], thus not being able to achieve real time imaging).

Several applications of such imaging techniques are presented, for dental medicine [12]: (i) to detect defects in metal ceramic dental prostheses [4]; (ii) to assess the quality of the interface between the ceramic inlay and the tooth [13]; (iii) to monitor the drilling process during the treatment of dental cavities, in order to avoid opening the pulp chamber [14]. Other, on-going researches, such as metallic fracture assessment [15] or roughness evaluation using OCT are also presented.

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