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동맥경화반 정밀 진단과 치료를 위한 통합형 혈관 내 근적외선 카테터 플랫폼 개발

Development of an Integrated Intravascular Near-Infrared Catheter Platform for Precision Diagnosis and Therapy of Atherosclerotic Plaques

Abstract

Atherosclerosis remains a leading cause of cardiovascular mortality, necessitating advanced imaging and therapeutic strategies for vulnerable plaque management. We present an intravascular near-infrared catheter platform that integrates optical coherence tomography (OCT), near-infrared fluorescence (NIRF) imaging, and photodynamic therapy (PDT) for comprehensive diagnosis and treatment of atherosclerotic plaques. An OCT system incorporating dual-spectrum NIRF was developed, employing modulated laser excitation to eliminate fluorescence crosstalk and enabling simultaneous acquisition of structural and multiplexed molecular signatures for detailed plaque vulnerability assessment. The diagnostic OCT-NIRF module was further combined with a therapeutic PDT channel within a single catheter, allowing a seamless transition from lesion identification to targeted phototherapy. This integrated multimodal platform enables precise, image-guided diagnosis, monitoring, and treatment of inflamed plaques, demonstrating potential for cardiovascular phototheranostics.

Brief Biosketch

김연훈 박사는 한국과학기술원(KAIST)에서 기계공학 박사 학위를 취득하고 현재 KAIST 기계기술연구소 박사후연구원으로 재직 중이다. 주요 연구 분야는 공간섭단층촬영(OCT)과 근적외선 형광영상(NIRF)을 결합한 혈관 내 다중 모달 영상 시스템을 활용하여 동맥경화반을 정밀 진단하고, 광역학치료(PDT)를 통한 병변 치료까지 통합할 수 있는 테라노스틱(theranostic) 카테터 시스템 개발이다.

Yeon Hoon Kim received his Ph.D. in Mechanical Engineering from KAIST and is currently working as a post-doctoral researcher at the Mechanical Engineering Research Institute, KAIST. His primary research focus is on developing theranostic catheter systems that integrate multimodal intravascular imaging combining OCT and NIRF for precise diagnosis of atherosclerotic plaques, with PDT for lesion treatment.