心血管健康监测的光子皮肤传感网络

DOI: 10.12086/oee.2024.241012.h02

为了满足在临床诊疗和日常健康管理方面日益增长的需求，一种精准的时空血流动力学监测技术是梦寐以求的。传统的石英材质光纤和人体皮肤相比具有力学特性上的巨大差异，且对人体微弱力学生理信号灵敏度低。现有的微光纤光子皮肤缺乏波长编码策略，不具备时间同步的多通道多参量传感能力。

南京大学现代工程与应用科学学院徐飞教授、陆延青教授团队联合南京鼓楼医院徐标主任医师团队针对上述难点提出了一种基于类皮肤微光纤光栅组的时空血流动力学监测技术。通过检测心血管系统近远端的机械信号而非电生理活动信号，该监测技术能够呈现全身心血管系统心脏搏动、血管扩张、脉搏波传播的真实的全力学过程。该研究提出了三种血流动力学检测工作模式。

该研究充分发展了基于微光纤光栅组的多通道同步传感技术，具有时间动态、空间分布、易组网可配置、高灵敏度、高柔性的显著优势，提出的时空血流动力学监测技术具备实时动态地评估全身心血管系统中局部血管健康状态的工作能力，在血栓、血管硬化、高血压等心血管疾病的精准诊疗、快速早筛、健康预警有着广泛的应用前景。

Opto-Electronic Advances, 2023, **6**(11): 230018.
https://www.oejournal.org/article/doi/10.29026/oea.2023.230018.

Photonic skin sensing network for cardiovascular health monitoring

DOI: 10.12086/oee.2024.241012.h02

Monolithic hemodynamic parameters achieved by current wearable devices cannot adequately and precisely reflect the health status of regional vasculature. A spatiotemporal hemodynamic monitoring technique is urgently needed to satisfy the ever-growing demand for clinical treatment and daily health management of the cardiovascular system.

The research group from College of Engineering and Applied Sciences of Nanjing University and Nanjing Drum Tower Hospital proposed a spatiotemporal hemodynamic monitoring technique based on a skin-like microfiber grating group. By detecting mechanical signals at the proximal and distal ends of the cardiovascular system instead of electrophysiological activity signals, the monitoring technique can present the real dynamics of the systemic cardiovascular system, such as heart beat, angiectasis, and pulse wave propagation.

This study develops the synchronous multi-channel sensing technology based on the skin-like μFBG group, which has significant advantages such as temporal dynamic, spatial distribution, easy networking and configurability, high sensitivity and high flexibility. The proposed technology has the working capability of real-time and dynamic evaluation of local blood vessel health status in the whole cardiovascular system, demonstrating the great potential in the diagnosis of cardiovascular diseases such as arrhythmia, angiosclerosis, hypertension, and thrombosis and facilitating precise clinical diagnosis, the fast screening of lesions, and daily health management.

Opto-Electronic Advances, 2023, **6**(11): 230018.
https://www.oejournal.org/article/doi/10.29026/oea.2023.230018.