Wrist-Worn Wearable Pulse Oximeter for the Remote and Continuous Health Monitoring Without Fingertip Sensor

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Photoplethysmography is the main technique utilized to measure pulse oximetry signals by analyzing the pulsatile components of the detected red and infrared light. Conventionally, this method makes use of transmitted and reflected light intensities. The major practical limitations of pulse oximetry at the wrist are the comparatively low-level and corrupted photoplethysmographic signal resulting from the low-density vascularity of the skin, and high motion artifacts. We discovered that there is a unique location on the wrist that never has been explored by others, and we developed a unique optical sensor using a trans-illumination configuration that results in a dramatic increase of the signal. In addition, a complementary dynamic light scattering (DLS) sensor was exploited for pulsatile blood flow measurements and pulse rate recovery at low perfusion situations. Physiological signals from both sensors were processed using a unique correlative algorithm. As a result, we were able to obtain an AC/DC ratio of around 0.5% whereas any other standard reflection configuration yields only 0.02-0.05% at the wrist. It should be noted that an AC/DC ration of 0.5% is not far from the commonly accepted 1-1.5% for the fingertip transmission signal. The fully functional prototype with Bluetooth transmission and smartphone application was built and verified in more than 100 clinical tests. The correlation between Oxitone and benchmark pulse oximeters was 0.91 (p=0.0001). Oxitone end users include COPD and asthma patients, OSA and CHF patients and elderly people requiring long-term care facilities at home or at points-of-care. The Oxitone wrist-worn pulse oximeter is the world's first wearable health monitor allowing comfortable and non-distracting continuous monitoring throughout daily activity.

Keywords: wrist, wearable, oximeter, monitoring, preventive