Development of non-invasive tissue oxygen consumption measurement method based on arterio-venous photoplethysmography

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Toward a development of noninvasive tissue oxygen consumption monitoring method, we propose an arteriovenous blood oxygen saturation measurement based on near-infrared spectroscopy. For arterial blood oxygen saturation measurement, we employ a conventional arterial blood oxygen saturation measurement method, pulse oximetry. Then, for venous blood oxygen saturation measurement, based on a similar principle of pulse oximetry, we developed a new venous blood photoplethysmographic oximetry using cyclic cuff compression technique (mean pressure: 10mmHg with 10mmHg amplitude, cyclic frequency: 0.1Hz). The noninvasive arteriovenous blood oxygen saturation measurement system comprises two-wavelength, 750/830nm. The calibration curve of blood oxygen saturation measurement was calibrated, without blood-drawing, using theoretical photon propagation model based on radiative transfer. The newly designed noninvasive arteriovenous blood oxygen saturation measurement system was evaluated with healthy subjects’ forearms during isometric hand-grip exercise. The noninvasive measurement system could offer reasonable blood oxygen saturation changes during the exercise and following resting period.