The Amplitude of the AC-coupled PPG Signal at Different Applied Pressures

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Abstract: By applying different external pressures on to a photoplethysmo-graphic (PPG) sensor, the amplitude of the AC–component of the signal will vary. Different results were obtained due to wavelength used and due to type of skin site. High pressures may be physiologically and practically unrealistic to use. The results indicate that pressures below 60 mmHg are sufficient.

INTRODUCTION

In photoplethysmography (PPG) a probe, containing a light source (e.g. a LED and a photodetector), is applied on the skin surface. The emitted light is absorbed, scattered and reflected in blood and tissue. The radiant power of the detected light varies due to variations in e.g. arterial pulsatile blood flow. This corresponds to the AC-coupled PPG signal and the amplitude varies with different parameters such as the arterial oxygen saturation [1].
Earlier it has been observed that an applied pressure on the PPG probe would give a more definable AC-coupled PPG signal. A study was therefore performed on healthy subjects.

METHOD

A specially designed sensor was used. The sensor head, containing the PPG probe, could freely be moved perpendicular to the skin surface.The pressure acting on the skin surface was achieved by applying a pneumatic pressure in a bellows within the sensor. The measurements were performed on forehead and forearm and two optical wavelengths were used, namely green light (560nm) and near infra-red light (880nm).

RESULTS

A common ideal pressure for both skin sites was not found. However, in case of forehead the AC signal reached a peak at approximately

60 mmHg for both wavelengths used. In case of forearm no such peak could be found using a wavelength of 880 nm and the signal increased as the applied pressure increased. Besides the amplitude of the PPG signal the signal characteristics is also determined by other parameters such as the signal-to-noise ratio, the physiological origin of the signal and the type of vascularization in the tissue underneath the probe.

REFERENCES

[1] L-G. Lindberg, C. Lennmarken and M. Vegfors, "Pulse oximetry - clinical implications and recent technical developments," Review article. *Acta Anaesthesiol.Scand.*, vol. 39, pp 279-287, 1995.