The Performance of a New Pulse Oximeter Generation to Motion and Low Perfusion Simulation during a Desaturation Procedure.

Hornberger H., Gehring H., Matz H., Schäfer R., Konecny E., Schmucker P. *Respir Care* 2000; 45(8): 993.

Introduction

A number of new generation pulse oximeters (PO) were compared while motion [1,2] and reduced perfusion [3] were simulated. Both artefacts significantly impaired pulse oximeter recordings and can lead to abortion of measurement [4,5.] However, it seemed appropriate to simulate the artefacts either alone or in combination in such a way, that the limits of pulse oximeter signal detection were challenged while the levels of peripheral arterial oxygen saturation were being altered.

Methods

Ten healthy volunteers participated after written informed consent and approval by the Ethics Committee were obtained. The PO battery on the left (test) hand consisted of a Datex-Ohmeda 3900, Agilent Technologies (formerly Hewlett-Packard) CMS monitor software Rev. B.0, a Nellcor/Mallinckrodt N-395, and a Schiller OX-1 (identical to an IVY 2000) incorporating Masimo SET technology. 3 Nellcor/Mallinckrodt N-3000 served to represent the established generation of pulse oximeters, one on the test hand and two as control monitors for the desaturation procedure on the right (reference) hand. During four repeated desaturation procedures between 75 and 100% SpO2, motion, reduced perfusion and the combination of these artefacts were simulated. Before the simulation, an induced hypoxemia without intervention served as control. Motion was simulated using a motor-driven tilt table which moves the forearm and hand of the participants. The Participants were also asked to scratch and tap their fingers on a platform. For introducing low perfusion without venous congestion, a balloon was inflated above the brachial artery of the test arm. Balloon inflation reduced finger perfusion, as indicated by a perfusion index measured on the test and reference fingers. The SpO2 data of the PO were recorded continuously and the differences between test and reference values (DSpO2) were evaluated and ordered with respect to the established four categories of interventions.

Results

Table 1 shows the percentage of time (in %), where the error (E) was in the range -3 £ DSpO2 £ 3 (E 3) and -6 £ DSpO2 £ 6 (E 6) respectively. Results are given for the four categories of intervention.

Interventions	**N 3000**		**N 395**		**Agilent**		**D-O 3900**		**IVY 2000**	
No motion, normal perfusion	99.9	100	98.2	99.8	95.7	99.1	98.3	100	97.7	99.9
No motion, low perfusion	95.4	98.8	88.5	98.2	90.9	95.5	89.9	97.3	93.1	99.4
Motion, normal perfusion	89.7	95.4	88.0	95.8	78.6	91.6	84.5	89.3	79.0	91.5
Motion, low perfusion	47.5	73.6	60.7	86.9	45.7	73.6	56.8	79.4	54.9	72.8
	E 3	E 6	E 3	E 6	E 3	E 6	E 3	E 6	E 3	E 6