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The authors, editors, and publisher have exerted every effort to ensure that drug selection and dosage, as well as the description of instruments and recommendations for their use, set forth in all articles appearing in the *Journal of Clinical Monitoring* are in accord with current recommendations and practice at the time of publication. However, many considerations necessitate caution in applying in practice information reported in any article appearing in the *Journal*. These include ongoing research, changes in government regulations, variations in standards among different countries, the possibility that original research as reported in the *Journal* may differ from standard practice, and the constant flow of information relating to drug therapy and drug reactions, as well as the principles of monitoring, application of instruments, and differences in instruments among manufacturers. The reader is advised to check the package inserts for each drug for change in indication and dosage, and the descriptions provided by instrument manufacturers for added warnings and precautions. This caution is particularly important when the recommended drug or instrument is new or infrequently employed.

The *Journal of Clinical Monitoring* is indexed in *Index Medicus*, *Current*

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SKIN REFLECTANCE PULSE OXIMETRY: IN VIVO MEASUREMENTS FROM THE FOREARM AND CALF

Y. Mendelson, PhD, and M. J. McGinn, MSc

Mendelson Y, McGinn MJ. Skin reflectance pulse oximetry: in vivo measurements from the forearm and calf.
J Clin Monit 1991;7:7–12

ABSTRACT. This study describes the results from a series of human experiments demonstrating the ability to measure arterial hemoglobin oxygen saturation (SaO_2) from the forearm and calf using a reflectance pulse oximeter sensor. A special optical reflectance sensor that includes a heating element was interfaced to a temperature controller and a commercial Datascope ACCUSAT pulse oximeter that was adapted for this study to perform as a reflectance pulse oximeter. The reflectance pulse oximeter sensor was evaluated in a group of 10 healthy adult volunteers during steady-state hypoxia. Hypoxia was induced by gradually lowering the inspired fraction of oxygen in the breathing gas mixture from 100 to 12%. Simultaneous SaO_2 measurements obtained from the forearm and calf with two identical reflectance pulse oximeters were compared with SaO_2 values measured by a finger sensor that was interfaced to a standard Datascope ACCUSAT transmittance pulse oximeter. The equations for the best-fitted linear regression lines between the percent reflectance, $SpO_2(r)$, and transmittance, $SpO_2(t)$, values in the range between 73 and 100% were $SpO_2(r) = -7.06 + 1.09\ SpO_2(t)$ for the forearm ($n = 91$, $r = 0.95$) and $SpO_2(r) = 7.78 + 0.93\ SpO_2(t)$ for the calf ($n = 93$, $r = 0.88$). The regression analysis of the forearm data revealed a mean ± SD error of 2.47 ± 1.66% (SaO_2 = 90–100%), 2.35 ± 2.45% (SaO_2 = 80–89%), and 2.42 ± 1.20% (SaO_2 = 70–79%). The corresponding regression analysis of the calf data revealed a mean ± SD error of 3.36 ± 3.06% (SaO_2 = 90–100%), 3.45 ± 4.12% (SaO_2 = 80–89%), and 2.97 ± 2.75% (SaO_2 = 70–79%). This preliminary study demonstrated the feasibility of measuring SaO_2 from the forearm and calf in healthy subjects with a heated skin reflectance sensor and a pulse oximeter.

KEY WORDS. Blood gas analyses. Monitoring: oxygen. Measurement techniques: pulse oximetry; optical plethysmography; reflectance oximetry. Equipment: pulse oximeters.

Transmittance pulse oximetry has become a widely used technique for noninvasively monitoring changes in arterial hemoglobin oxygen saturation (SaO_2). The technique is based on the spectrophotometric analysis of the optical absorption properties of blood combined with the principle of photoplethysmography.

In transmittance pulse oximetry, which is based on tissue transillumination, sensor application in adults is limited to several specific locations on the body, such as the finger tips, ear lobes, and toes. In infants, additional monitoring sites such as the palms and the feet have been used.

Recently, a new reflectance pulse oximeter has been introduced into the market. The oximeter, which is manufactured by Ciba-Corning (Ciba Corning Diagnostics, Medfield, MA), uses a special optical reflectance sensor for specific application to the forehead. Among the advantages of this technique, as advertised by the

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