Monitoring SpO_2 During Conditions Involving Low Peripheral Perfusion

Masimo Corporation was the first company to receive FDA clearance for the ability to accurately and continuously read SpO_2 values through motion. It was also the first company to receive FDA clearance to claim the accurate measuring of SpO_2 during low peripheral perfusion with its Masimo SET pulse oximeter. Masimo was able to accomplish this feat through its proprietary algorithm, hardware and sensor design. Through the use of specially designed low noise sensors (LNOP), cables designed to minimize electrical interference, and circuit boards designed to lower noise, Masimo engineers were able to obtain the signal during very weak pulsations to acquire accurate readings of SpO_2 and pulse rate. Masimo SET algorithms assist in picking up the pulsations in the midst of artifacts caused by motion and other artifacts. The result was a system that was able to monitor at low perfusion levels approximately 10 fold lower than the conventional pulse oximeters that were on the market. Today, Masimo continues to be the leader in read-through- motion and low perfusion technology.

The earliest report of Masimo's enhanced ability to read in low perfusion was in an abstract and poster presented at the 1995 Society for Technology in Anesthesia.[1] Researchers compared Masimo to several then current pulse oximeters during low perfusion caused by brachial artery clamping. They found that a Masimo SET prototype device had the lowest total error compared to 5 pulse oximeters: Nellcor (with and without C-Lock), Novametrix, Criticare, Ohmeda. In fact the total error for the Masimo was less than 2% while the best of the other competitors was greater than 32%. Total error was defined as percent of time the device was unable to give a reading plus the percent of time the device was greater than 3% from the control.

Since that report, Masimo has continued efforts focusing on maximizing sensitivity for detecting pulsation and SpO_2 values in patients suffering from extremely low cardiac output and/or low local perfusion levels. An important clinical advantage of increased sensitivity is that the Masimo pulse oximeter provides valuable information (when other pulse oximeters can not) in critical environments and situations where very low perfusion can occur such as: ICU, Trauma, Cardio-Pulmonary Bypass and resuscitation.[3-17] The improved low perfusion capabilities of Masimo SET technology have been shown to be capable of monitoring SpO_2 and PR during extremely low perfusion and in fact have been reported to correctly monitor adequacy of chest compression during resuscitation in neonatal patients.[17]

It is important to understand the concept of "signal to noise ratio" when considering the problem of monitoring SpO_2 during low perfusion. Low perfusion results in a very small amplitude signal, which can become so low as to be difficult to distinguish from the background noise. Detecting the actual SpO_2 signal during low perfusion situations is made more difficult during periods of motion. In effect, the motion raises the background noise level thereby making it even more difficult to distinguish the small amplitude SpO_2 signal during low perfusion. The clear advantage of Masimo SET is in the ability to accurately measure SpO_2 during the worst of all situations, periods of low perfusion and motion. Numerous studies have shown the Masimo's SET technology is clearly superior to all other pulse oximeters during conditions of motion and low perfusion.[2,3,5,6,9,14,15,16]

Critically ill patients are at risk of developing low peripheral perfusion. Clinicians may not always be able to reliably predict when patients may develop this condition. Therefore, reliable pulse oximetry needs to function accurately whenever presented with conditions of low perfusion. Masimo SET provides just that; accurate and reliable pulse oximetry during conditions of low perfusion.

masimo corporation 40 parker irvine ca 92618 www.masimo.com

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masimo corporation 40 parker irvine ca 92618 www.masimo.com

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