Does Machine Generated or Volunteer Generated Motion Influence Accuracy of Motion Resistant P0s?
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Introduction
New generation "Motion Resistant" Pulse Oximeters (PO) have been studied in volunteers with machine generated motion (MGM) and volunteer generated motion (VGM). It is unclear whether test methodology affects P0s performance. This study evaluated the effects of MGM and VGM using three motion resistant P0s, during normoxia and hypoxia in presence of low perfusion during motion in volunteers.

Methods
Following informed consent, 10 ASA-I volunteers (5F & 5M) between 18-40 years old, were enrolled. P0s tested were Masimo Radical (V5.0), Nellcor N-600 (V1.1.2.0), and Datex Ohmeda TruSat. Sensors were randomly placed on index, middle, and ring fingers of left hand (test), and right hand (control), and were optically shielded. The room temperature was lowered to 16-18°C to reduce peripheral perfusion. A Masimo Radical PO on the right ear served as the control during hypoxia. Volunteers were tested during separate room air and desaturation (employing a disposable re-breathing circuit with a CO2 absorber to a SpO2 of 75% on control PO, and the subject was then given 100% oxygen until the control SpO2 reached 100%) events. Volunteers were subjected to random tapping (with sensor disconnect/reconnect) and random rubbing motions. Motions were machine generated (MGM) and volunteer generated (VGM) (volunteered were instructed to perform tapping and rubbing on their own instead of employing machine). The sensors were rotated laterally and tested on all three fingers during the room air events. A computer recorded SpO2 & pulse rate (PR) data. A missed event ("ME", false negative/sensitivity) was defined as the inability of the PO to detect desaturation and to recover from a desaturation by the time the control reached 100%. A false alarm ("FA", false positive/specificity) was recorded during the normoxic phase, and defined as a SpO2 ≤ 90% during motion. Failure rates (FR) is the % of time P0s were off by 7% ("E7") for SpO2 & off by 10% ("E10") for PR. Recovery time (RT) is defined as time required for the P0s to recover SpO2 and PR to control value. Zero Out (% of time when the P0s zero out SpO2 and/or PR) was calculated. A Zero Out also included the time when the monitor displayed "--". ANOVA and Fischers post hoc test were performed for statistical analysis. P<0.05 was considered statistically significant.

Results
There were a total of 160 motion tests; 40 with desaturations and 120 on room air; 80 during machine generated and 80 during self-generated motions. We detected FA 34 times with MGM vs. 20 with VGM. There were 23 ME with MGM, and 28 with VGM. The table shows the remaining results. We did not find any statistically significant difference between MGM and VGM in any of the recorded or calculated parameters.

<table>
<thead>
<tr>
<th>MACHINE GENERATED</th>
<th>RECOVERY TIME</th>
<th>E7</th>
<th>E10</th>
<th>ZERO OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>MGM</td>
<td>.44 ± .80</td>
<td>2.5 ± 2.8</td>
<td>3.8 ± 2.7</td>
<td>.35 ± 1.1</td>
</tr>
<tr>
<td>VGM</td>
<td>.60 ± 1.1*</td>
<td>2.3 ± 2.3*</td>
<td>3.5 ± 2.7*</td>
<td>.60 ± 1.6*</td>
</tr>
</tbody>
</table>

* = Statistically Non Significant compared to MGM

Conclusions
MGM was found to be similar to VGM during evaluation of motion resistant P0s, hence either methodology can be utilized to evaluate the performance of new generation motion resistant P0s.