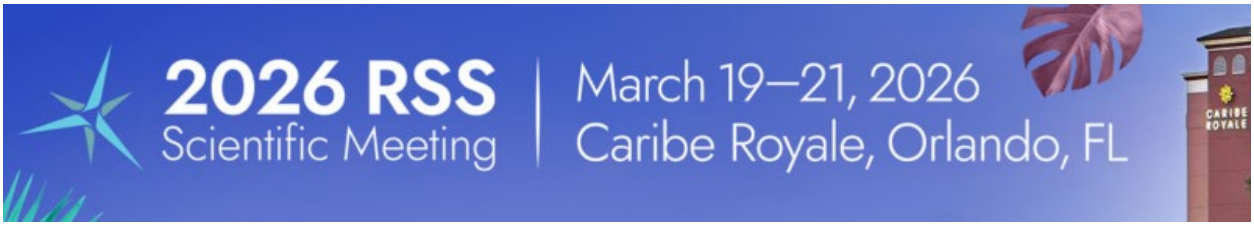

Pulse Oximetry Monitoring System for Gyroscopic Radiosurgery

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Objectives: ZAP-X is the newest cranial stereotactic radiosurgery (SRS) platform. ZAP-X SRS patients may require monitoring of vital signs such as pulse and blood oxygen level (SpO2). There are no reports describing a vital sign monitoring system for ZAP-X SRS. The objective of this study is to evaluate a pulse oximetry monitoring system that can be utilized for ZAP-X SRS.

Methods: An Expression MR400 monitor (Philips, Amsterdam) was positioned 7 ft from the ZAP-X system. The monitor consists of a 15" LED touchscreen display with wireless radiofrequency (RF) connection (RF Range: 2402 – 2482 MHz, Modulation Type: GFSK, Wireless Processing Unit EIRP: 4.2 dBm peak, SpO2 EIRP: 0 dBm peak) to a pulse oximeter clip situated on the patient's index finger. Pulse is displayed as beats per minute (bpm) and SpO2 measurements are displayed as a waveform and numeric given as a percentage. The monitoring system was evaluated on a single SRS patient over the course of 3 treatment days. For each day, pulse and SpO2 measurements were recorded before treatment for baseline at 10 second intervals over 30 minutes. Pulse and SpO2 measurements were recorded during treatment at 10 second intervals until the end of treatment. Paired t test was used to assess statistical differences between baseline and treatment pulse oximetry distributions, with $P < 0.05$ significance.

Results: For the first treatment day, the average baseline and treatment pulse was 95 ± 0.3 bpm (range: 94 – 96 bpm) and 93 ± 0.6 bpm (91 – 96 bpm) ($P = 0.4953$), the average baseline and treatment SpO2 was 99 ± 0.4% (98 – 100%) and 98 ± 0.7% (97 – 99%) ($P = 0.4031$). The second treatment day, the average baseline and treatment pulse was 92 ± 0.3 bpm (range: 89 – 93 bpm) and 90 ± 0.7 bpm (87 – 96 bpm) ($P = 0.3997$), the average baseline and treatment SpO2 was 99 ± 0.3% (99 – 100%) and 98 ± 0.6% (97 – 99%) ($P = 0.4018$). The third treatment day, the average baseline and treatment pulse was 93 ± 0.4 bpm (range: 90 – 95 bpm) and 89 ± 0.8 bpm (88 – 93 bpm) ($P = 0.2244$), the average baseline and treatment SpO2 was 99 ± 0.4% (98 – 100%) and 97 ± 0.8% (96 – 99%) ($P = 0.1991$). There was no significant difference between baseline and treatment pulse oximetry distributions.

Conclusion(s): The Expression MR400 RF signal can effectively propagate through ZAP-X shielding with minimal electromagnetic interference during treatment. The Expression MR400 provides accurate pulse oximetry monitoring during ZAP-X SRS. The pulse oximetry system can be utilized for patients that require sedation, benzodiazepine medication, and cardiac condition monitoring.