

Background & Aim

Monitoring newborn temperature at birth is a crucial part of stabilisation as hypothermia is associated with adverse outcomes. We have developed a novel multiparameter sensor (MPS) that continuously measures SpO₂, ECG, and skin temperature.

We aimed to develop an in-vitro model to measure surface temperature during delivery room care and assess MPS accuracy and time to reach core temperature.

Methods

An in-vitro model of a preterm infant was developed using a 500 mL saline bag heated to 37.5±1°C and placed under a Dräger Resuscitaire radiant heater at three settings: 0% (room temperature), 50%, or 100% power (n=3/experiment/setting).

Core temperature (CT) was measured with a temperature probe inside the saline bag. Surface temperature was measured with a GE 400 Series reusable skin temperature probe (SSP) placed on top of the saline bag next to the MPS, and data recorded every 30 seconds over a 30-minute period. Time taken for the SSP and MPS to reach within 0.1°C of CT were compared.

Results

Mean (±SD) values were calculated for the MPS, SSP, and CT at 30-second intervals.

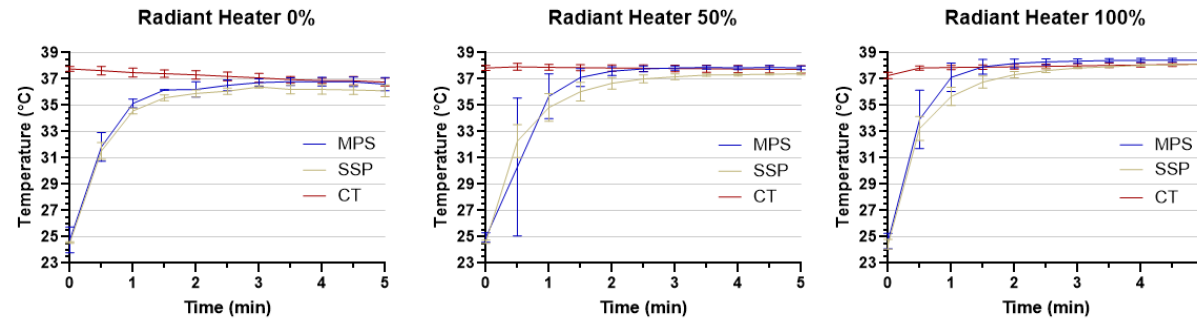


Figure 1. Mean (±SD) core and SSP/MPS temperatures over the first 5 minutes at 0% radiant heat power. The MPS temperature reached within 0.1°C of CT at 240 seconds; the SSP was unable to reach this endpoint, coming closest at 0.38°C at 29 minutes 30 seconds.

Figure 2. Mean (±SD) core and SSP/MPS temperatures over the first 5 minutes at 50% radiant heat power. The MPS temperature reached within 0.1°C of the CT at 150 seconds; the SSP was unable to reach this endpoint, coming closest at 0.23°C at 11 minutes 30 seconds.

Figure 3. Mean (±SD) core and SSP/MPS temperatures over the first 5 minutes at 100% radiant heat power. The MPS temperature reached within 0.1°C of the CT at 90 seconds. The SSP reached within 0.1°C of the CT at 210 seconds.

Time to reach within 0.1°C of Core temperature (seconds)			
Radiant heat power	0%	50%	100%
SSP	DNR*	DNR*	210
MPS	240	150	90

*Did not reach temperature endpoint

Table 1: Comparison of time taken by SSP and MPS to reach within 0.1°C of core temperature

Discussion

The VSP consistently demonstrated readings closer to core temperature when compared to the SSP and achieved this more rapidly at all radiant heat settings.

The SSP failed to reach within 0.1°C of the core temperature at radiant heat power of 0% and 50% by 30 minutes, with the VSP reaching within 0.1°C of the core temperature 2.3 times faster than the SSP at radiant heat power of 100%.

There were periods during which the VSP read higher than the CT, although this difference remained within 0.4°C (with 100% radiant heat power). This has been addressed in the latest VSP prototype with the use of shielding which is currently undergoing testing.

Conclusion

A novel multiparameter device quickly and accurately measures core temperature in a variety of in-vitro experimental settings compared with a current, clinically used skin surface temperature probe. The MPS could enhance delivery room thermoregulatory management.