DESIGN AND PRELIMINARY EVALUATION OF A COOLING/HEATING DEVICE TO ASSESS MICROVASCULAR FUNCTION IN HUMAN SKIN

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In order to investigate the skin local vasomotor response to a variation in cutaneous temperature in human, we made a new local cooling/heating device associated with a laser Doppler flowmeter. We further tested the skin response to local cooling down to 15°C and its reproducibility.

The cooling/heating probe is made of paired optic fibres and a Peltier element as a thermoelectric cooler. The direction of the heat flow depends on the polarity of the voltage supplied, allowing either heating or cooling of a single surface. We performed local cooling on the forearm of 6 healthy volunteers from 33°C to 24°C and then to 15°C, twice, and repeated the measurement 7 days later. Data are expressed as cutaneous vascular conductance (CVC) in mV/mmHg.

Local cooling decreased CVC between 33°C, 24° and 15°C ($p<0.05$ for all series, Friedman test). Short-term reproducibility was excellent (CV=8-11%). 7-day reproducibility was poor when data were expressed as raw values (CV=40-64%) but better when expressed as %baseline (CV=29-42%). The 30-minute cooling showed typical traces with an initial decrease in CVC, inconstantly followed by a peak around 5 minutes after the cooling onset. The cooling/heating device was well tolerated by all the volunteers.

In conclusion, this prototype permitted to perform local cooling, leading to a temperature-dependant, local, reproducible vasoconstriction. This new tool could be of great interest to assess microcirculation function in human skin in diseases such as Raynaud's phenomenon.

Keywords: cooling; microcirculation; laser Doppler; Raynaud's phenomenon.