JTV Editorial

Title: **It is time to be “cool” about maintaining skin integrity**

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The award of the 2021 Nobel Prize in Physiology and Medicine to Professors David Julius and Ardem Patapoutian for their discovery of the molecular basis of skin temperature and pressure sensing has put the skin, the extensive organ that envelops the human body, under the spotlight of global scientific attention. Sensing temperature and touch on the skin is one of the most fundamental sensory functions in humans. It both connects us and enriches our experiences with the surrounding world, such as when we receive a warm, familiar caress. Temperature and touch sensing also offer an essential, first line of protection from environmental stimuli, such as heat, cold, and pressure, all of which can challenge our health and comfort.

Readers of JTV are well conversant with the fact that sustained mechanical pressure, as induced by prolonged periods in lying and sitting postures, as well as the attachment of medical devices, can provide a significant threat to the maintenance of skin health. The exposure to pressure and shear forces can induce skin damage and ultimately contribute to the formation of painful and debilitating pressure ulcers (PUs). It is also well accepted that the changes in microclimate at the skin/support interface, for example increases in temperature and/or humidity, will influence the tolerance of the skin to mechanical loads. As an example, early animal studies reported that an increase in temperature of pressure loaded skin from 35 to 45℃ exacerbated the depth and extent of resulting skin damage [1]. By contrast cooling temperatures can provide protection from the effects of external pressure. Indeed, evidence indicates that reduced skin temperatures during applied mechanical loading in an animal model can reduce local metabolic demands and protect the skin against pressure-induced ischemia and tissue necrosis [2].

Despite the intrinsic associations between temperature and pressure in almost all skin interactions with the external world, the mechanistic role of temperature in skin integrity under mechanical loading has been largely overlooked. This is particularly surprising, when considering the potential protective effects of skin cooling against pressure-induced skin damage. Cooling the skin could offer a feasible and practical intervention to enhance skin tolerance to mechanical pressure, in a similar manner to the approach adopted to protect cardiac tissues in animal models [3]. Indeed, there are now many mattress and cushion designs which target the local microclimate, providing active and passive heat transfer and moisture wicking technologies [4]. However, to date, the science underpinning the exact benefits to skin health and pressure tolerance are unknown.

Understanding the interplay between temperature and pressure, and their role on skin integrity, is clearly complex, particularly if this extends beyond the physiological effects of temperature to incorporate perceptual aspects. Indeed, while skin cooling may provide protection against pressure, it can also induce discomfort [5], which is a known barrier to the implementations of pressure-preventing interventions.

Discoveries from the Nobel Laureates have revealed that skin temperature and touch sensing mechanisms serve a dual role in both autonomic responses (e.g. body temperature regulation, respiration) and behavioural processes (e.g. pain and comfort-seeking behaviours), and that these may be dysregulated in vulnerable patient groups such as people with Multiple Sclerosis [6]. Accordingly, finding a balance between discomfort and physiological benefits of skin cooling may help developing “user-centred” or personalised therapeutic approaches that are both protective and comfortable.

We believe that the time has come for this aspect of tissue viability to be considered “cool” in maintaining skin integrity and there should be a re-focus of attention to skin thermo-mechanical interactions.

**References**

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