

# Laser speckle contrast imaging of Raynaud phenomenon

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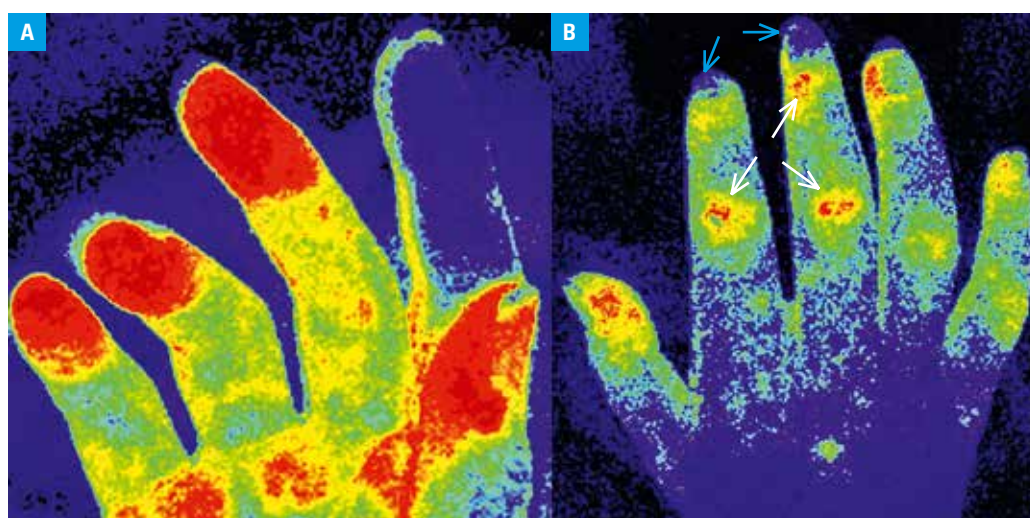
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Raynaud phenomenon is an episodic vasospasm of the peripheral microvessels in response to cold or stress. It can be primary, or less frequently secondary, to a systemic disease, the most frequent being scleroderma. The pathophysiology is most likely related to abnormal digital microvascular sensitivity to sympathetic stimulation that may also involve an abnormal response of the endothelium. Owing to its small size and regional heterogeneity, studies of the skin microcirculation remain challenging and the only routine method is videocapillaroscopy for evaluating microvascular structure. In addition, skin microvascular dysfunction has been described in many cardiovascular disorders.

Laser speckle contrast imaging (LSCI) is a recently developed technique that allows noninvasive, noncontact, and real-time monitoring of

peripheral microcirculatory blood flow on a large area of the body.<sup>1</sup> LSCI is user-friendly and shows very good reproducibility as well as excellent spatial and temporal resolutions.<sup>2</sup> In clinical studies, LSCI coupled with reactivity tests enable to estimate the endothelial and neurovascular function.

We present the measurements of skin perfusion assessed by LSCI in patients with primary and secondary Raynaud phenomenon. **FIGURE 1** shows skin flux derived from speckle contrast analysis with colors ranging from blue (no perfusion) to red (high perfusion). LSCI provides a perfusion index proportional to skin blood flow and allows to record up to 100 images per second. **FIGURE 1A** presents a clear lack of perfusion in the index finger in a patient with primary Raynaud phenomenon. **FIGURE 1B** presents the hand of a patient with scleroderma. We can see ulcers in



**FIGURE 1** Measurement of the microvascular flux assessed by laser speckle contrast imaging; **A** – lack of perfusion in the index finger in a patient with Raynaud phenomenon, contrasting with high perfusion of the adjacent finger pads; **B** – Raynaud phenomenon secondary to systemic sclerosis: ulcers in the process of healing surrounded by an increased skin blood flow (white arrows); lack of perfusion of the last phalanges of the index and middle fingers at the site of recurrent ischemic ulcerations (blue arrows)

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the process of healing not associated with ischemia on the dorsal face of the hand and fingers surrounded by an area of increased skin blood flow, while the index and middle fingers show a lack of perfusion in the distal phalanges where recurrent ischemic digital ulceration occurs every winter.

The study of skin microcirculation is of great interest because it may offer insight into the pathophysiological mechanisms of cardiovascular disorders. However, it is particularly useful in diseases affecting the skin such as secondary Raynaud phenomenon.<sup>3,4</sup> Moreover, LSCI may be an innovative tool for quantifying microvascular response to pharmacological treatment.

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