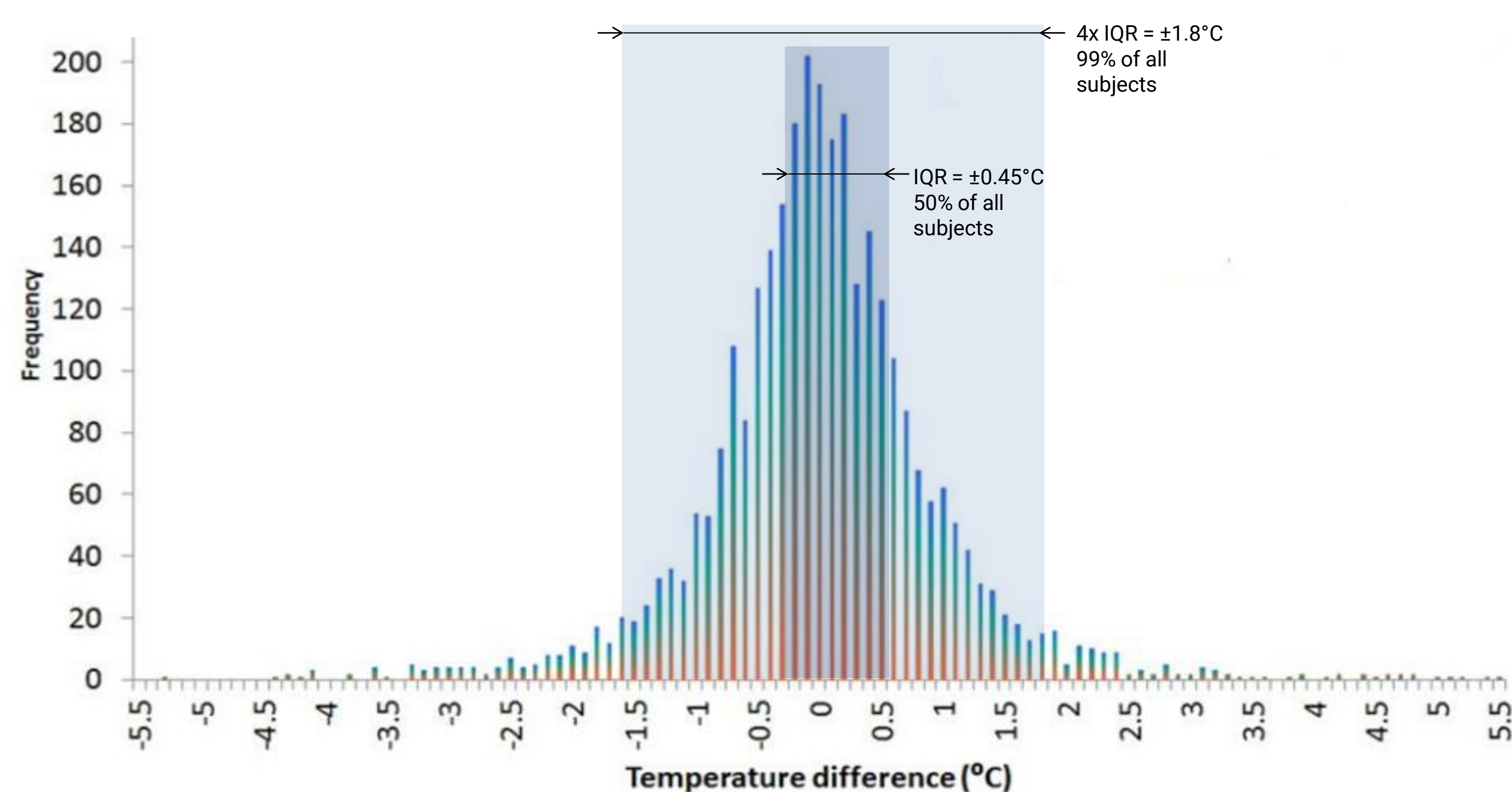


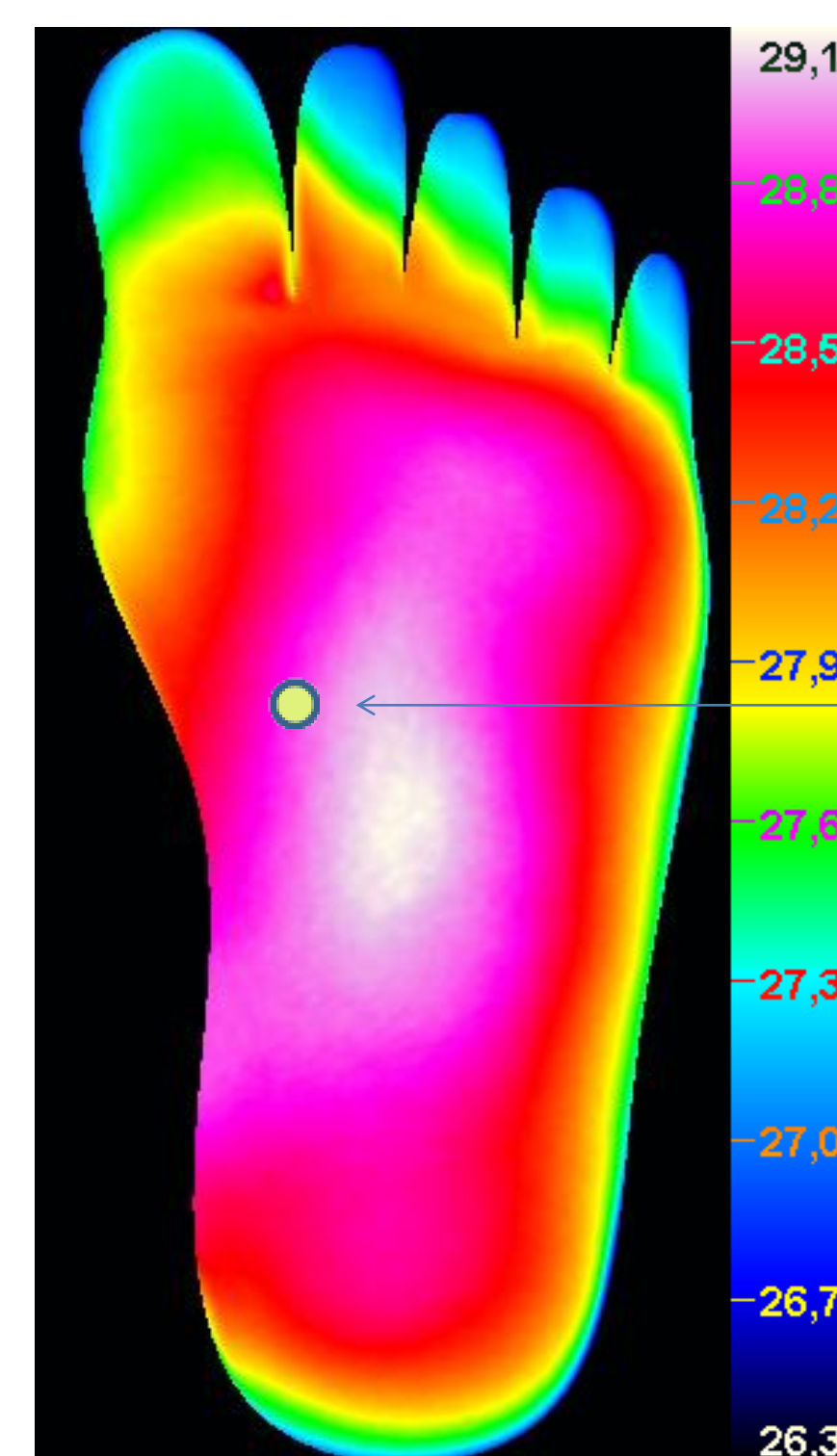
# Foot Temperature Assessment – A Review

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## The Normal Foot

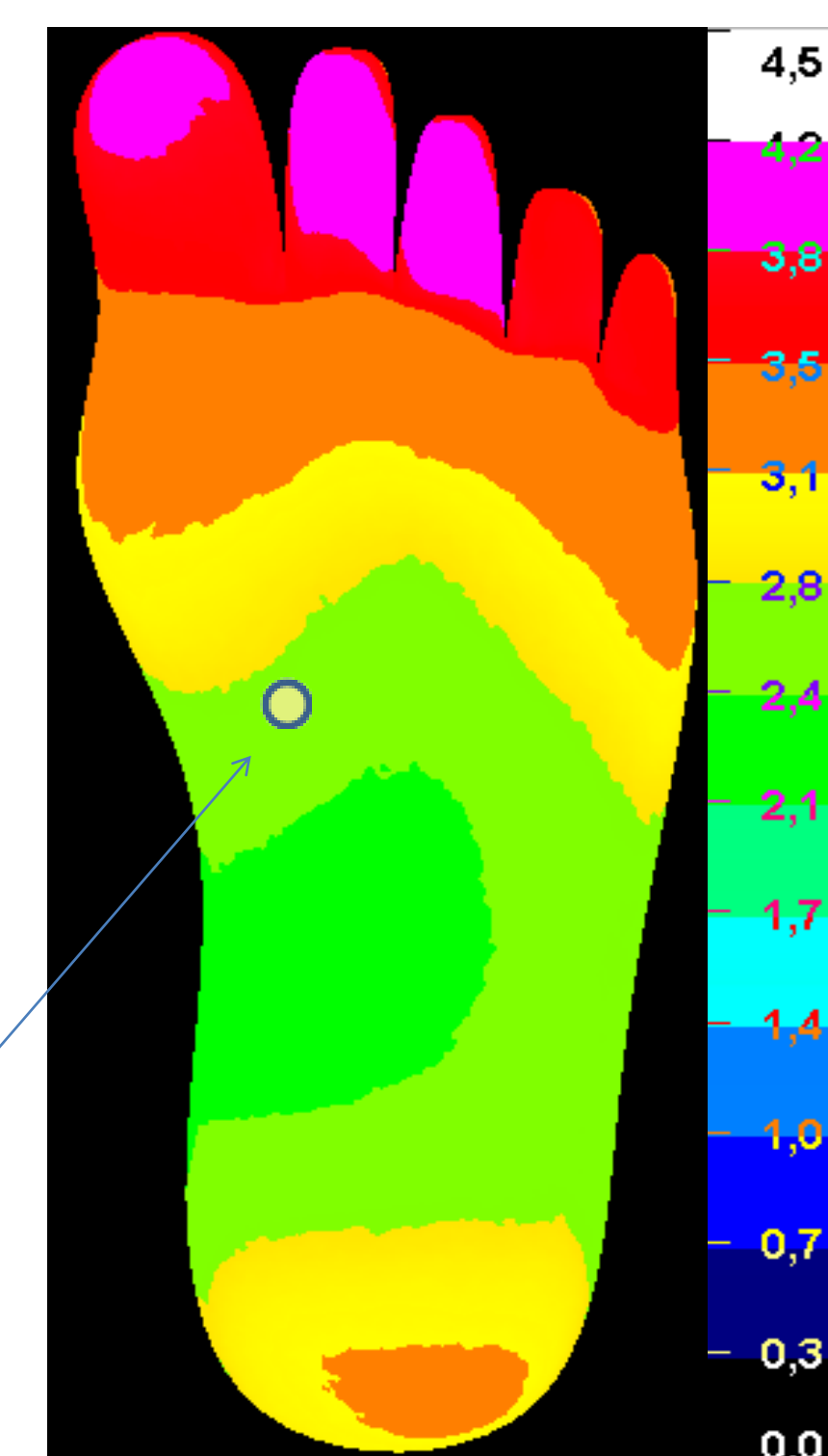


**Symmetry<sup>1</sup>** Feet are thermally highly symmetrical. The figure above shows a histogram of the left – right differences at 33 regions of interest in the feet of 103 healthy subjects (more than 3,000 data points). The width of the interquartile range (IQR) is 0.9°C, i.e. 50% of all aspects in one foot differ by less than 0.45°C from those of the other foot, 99% less than 1.8°C.



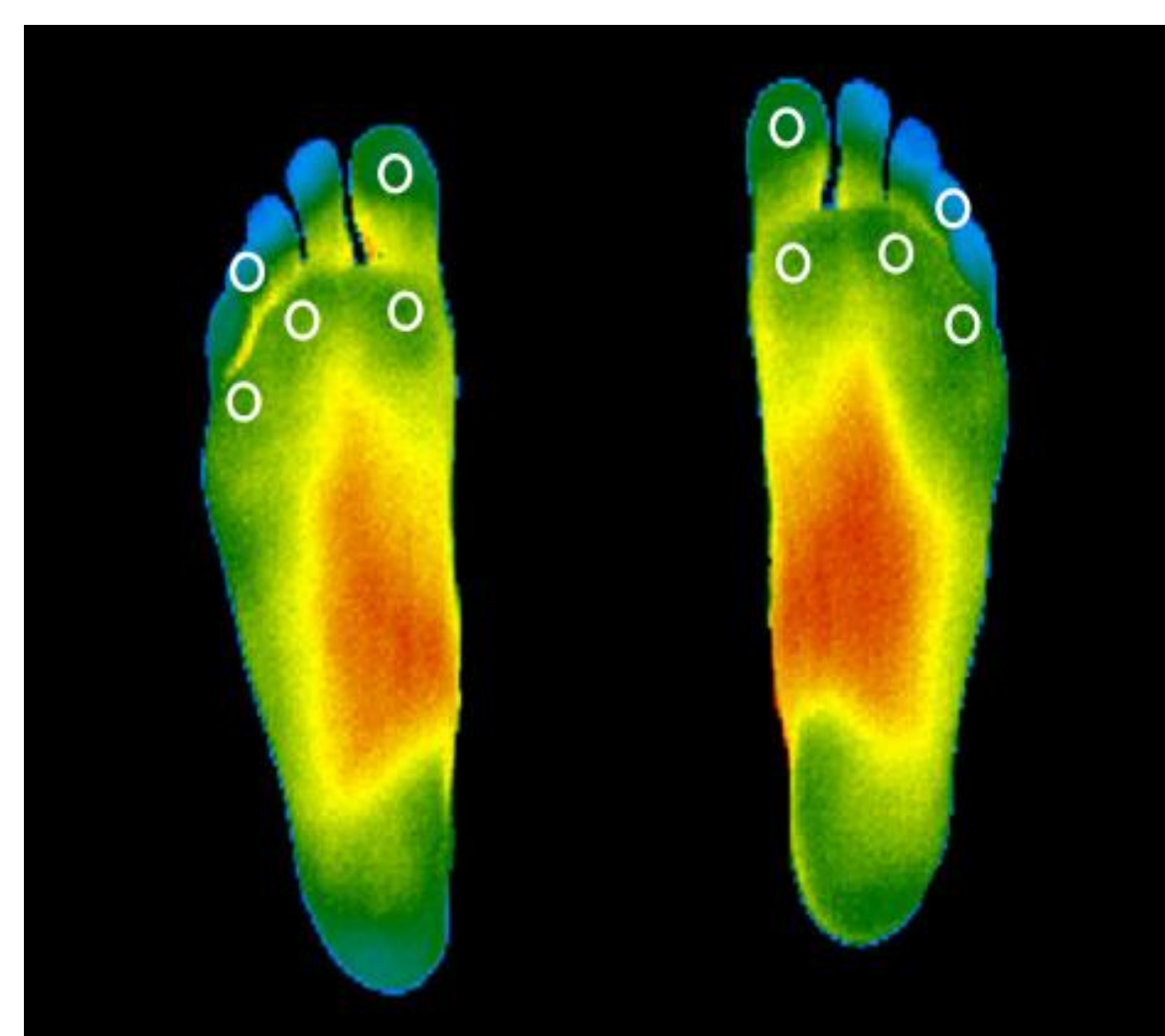
In a normal foot this point has an average temperature of 28.5 °C (from the left image).

However, in 68% of people this temperature differs inside a band between -2.4 °C and +2.4 °C (from the right image), i.e. between 26.4 °C and 30.9 °C.



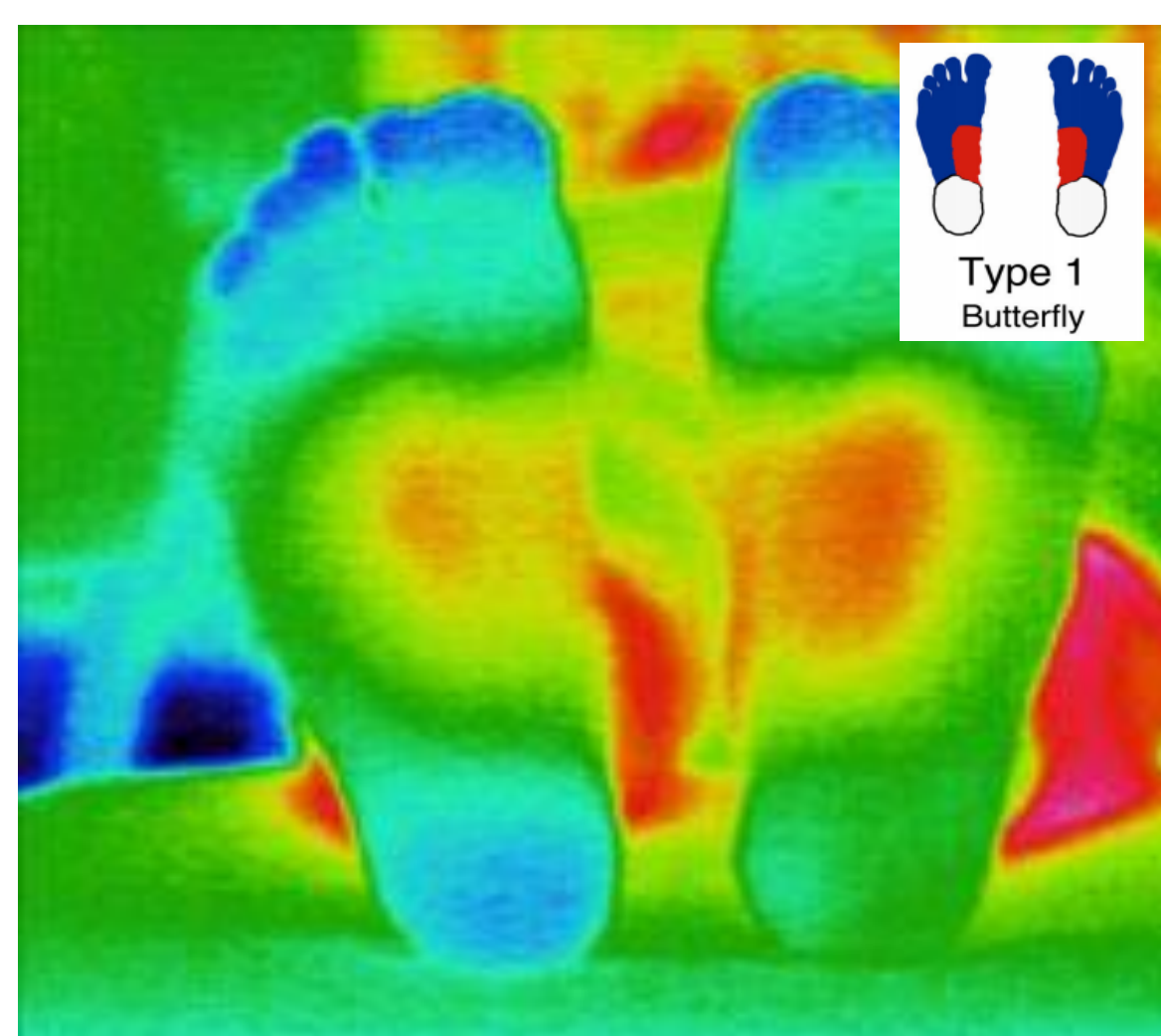
**Average Temperature<sup>2</sup>** Feet have a natural temperature gradient. The left figure shows the mean temperature distribution in the feet of 103 healthy subjects. The central plantar region is warmest, gradually declining towards the periphery, especially the toes. The right image shows the variation (1 std. Deviation, i.e. 68% of all cases) amongst the subjects.

## Detecting Foot Problems – 4 Approaches



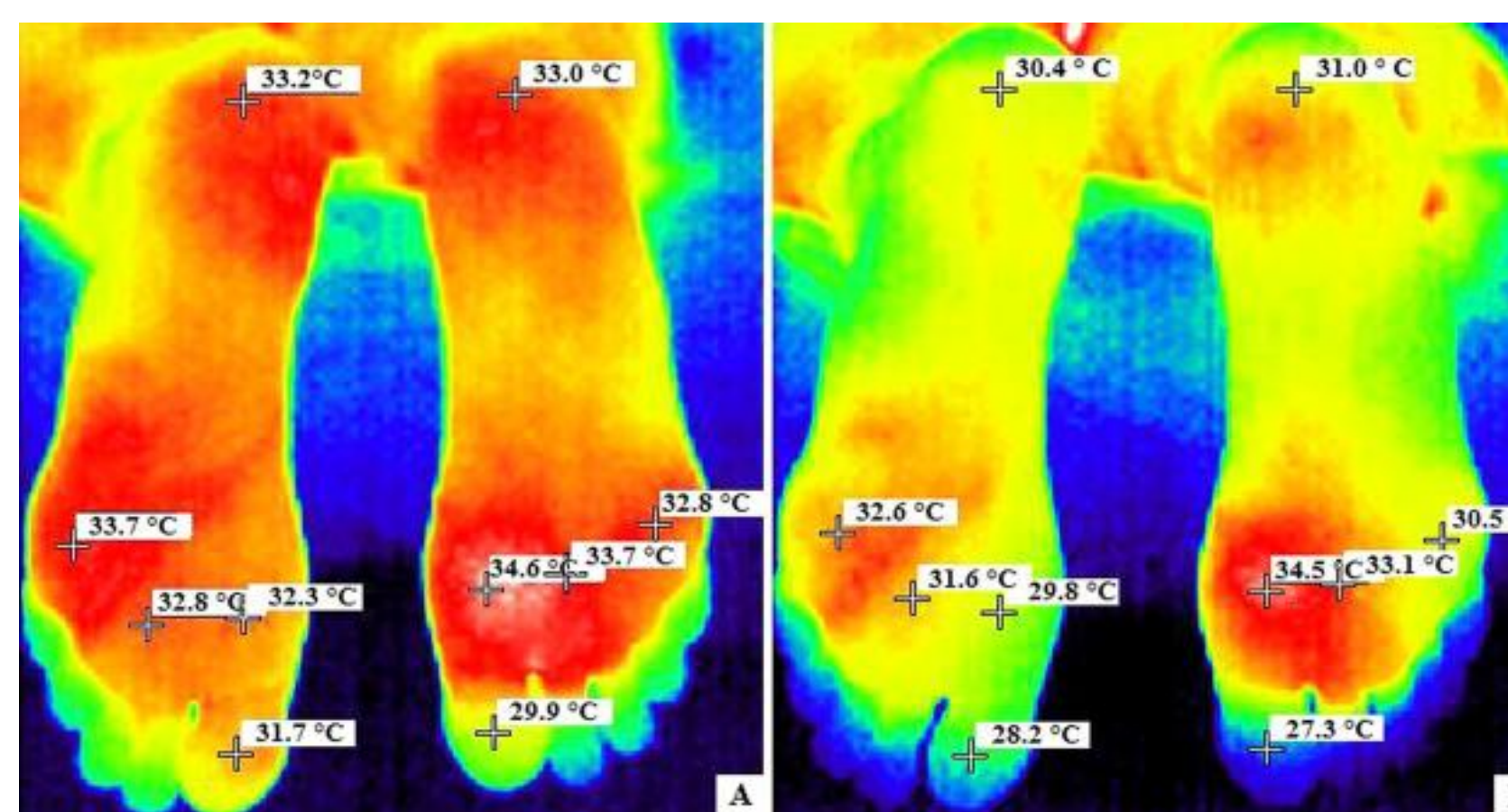
### 1. Asymmetry<sup>3</sup>

A breach of thermal symmetry beyond the expected variation (see above) may indicate complications.



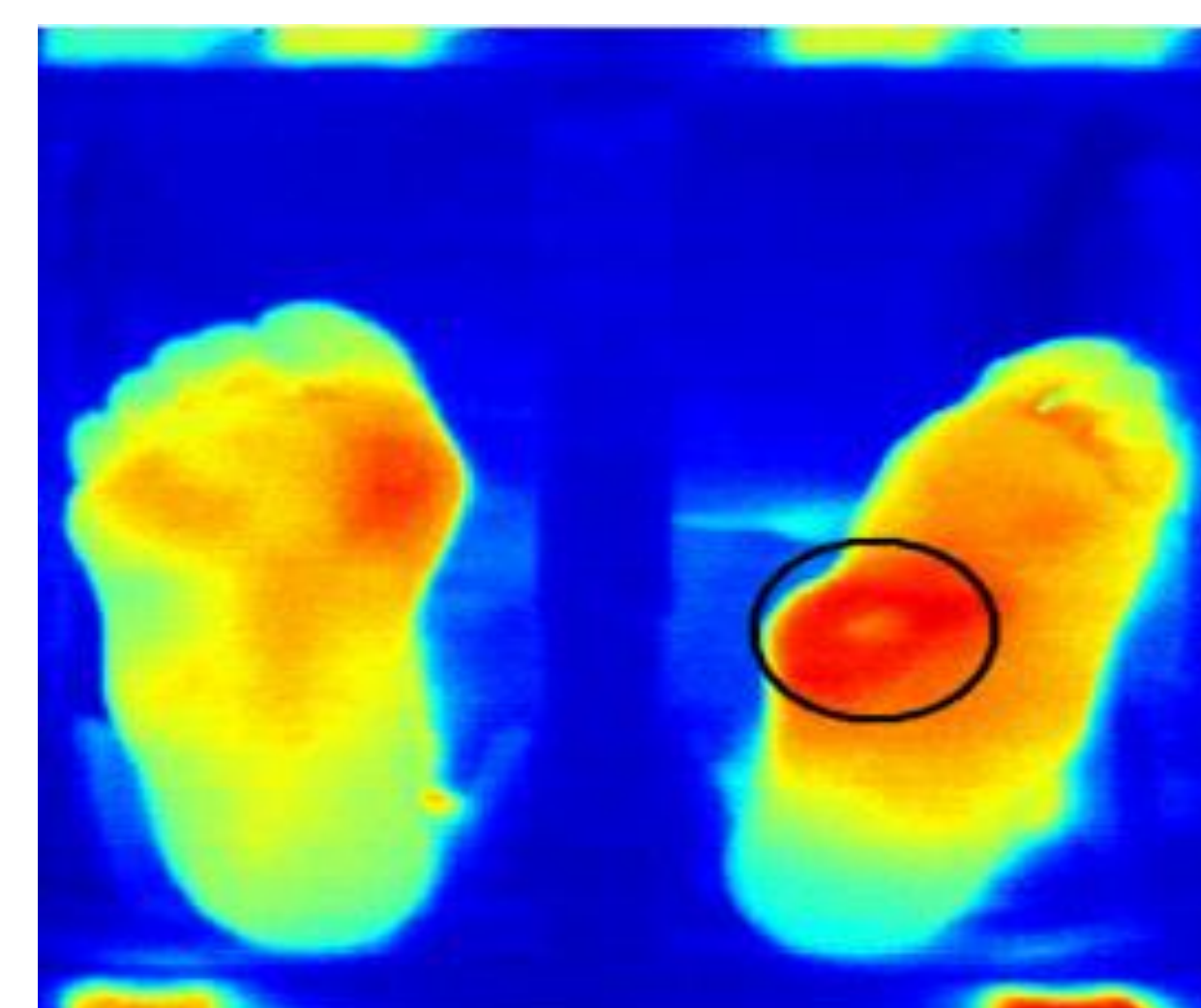
### 2. Pattern Analysis<sup>4</sup>

A deviation from the standard "butterfly" angiosome pattern could result from circulatory problems.



### 3. Changes over Time<sup>5</sup>

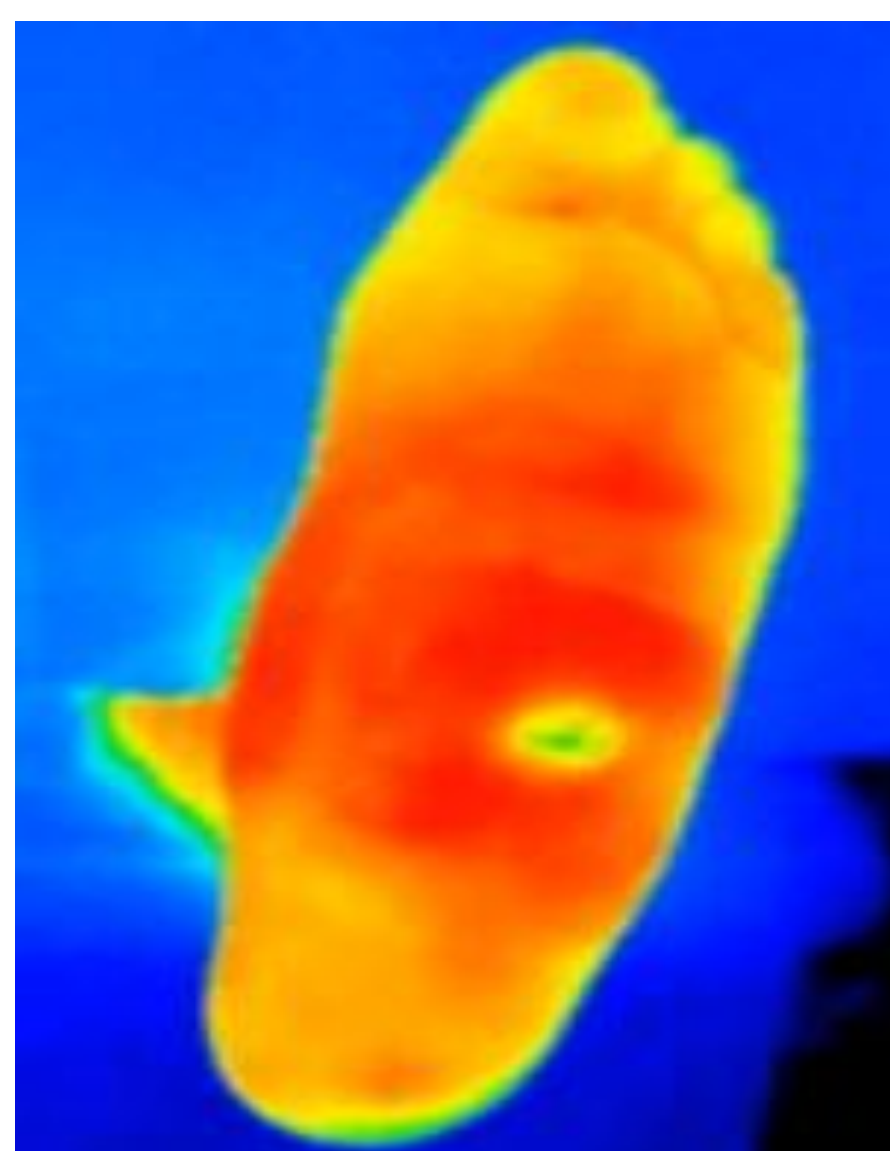
Short-term (minutes) changes such as those from baseline (A) via a mild cold stress (B) followed by re-warming (not shown) may elicit incidences of Raynaud's phenomenon. Long term (days) changes may point towards slowly progressing tissue damage.



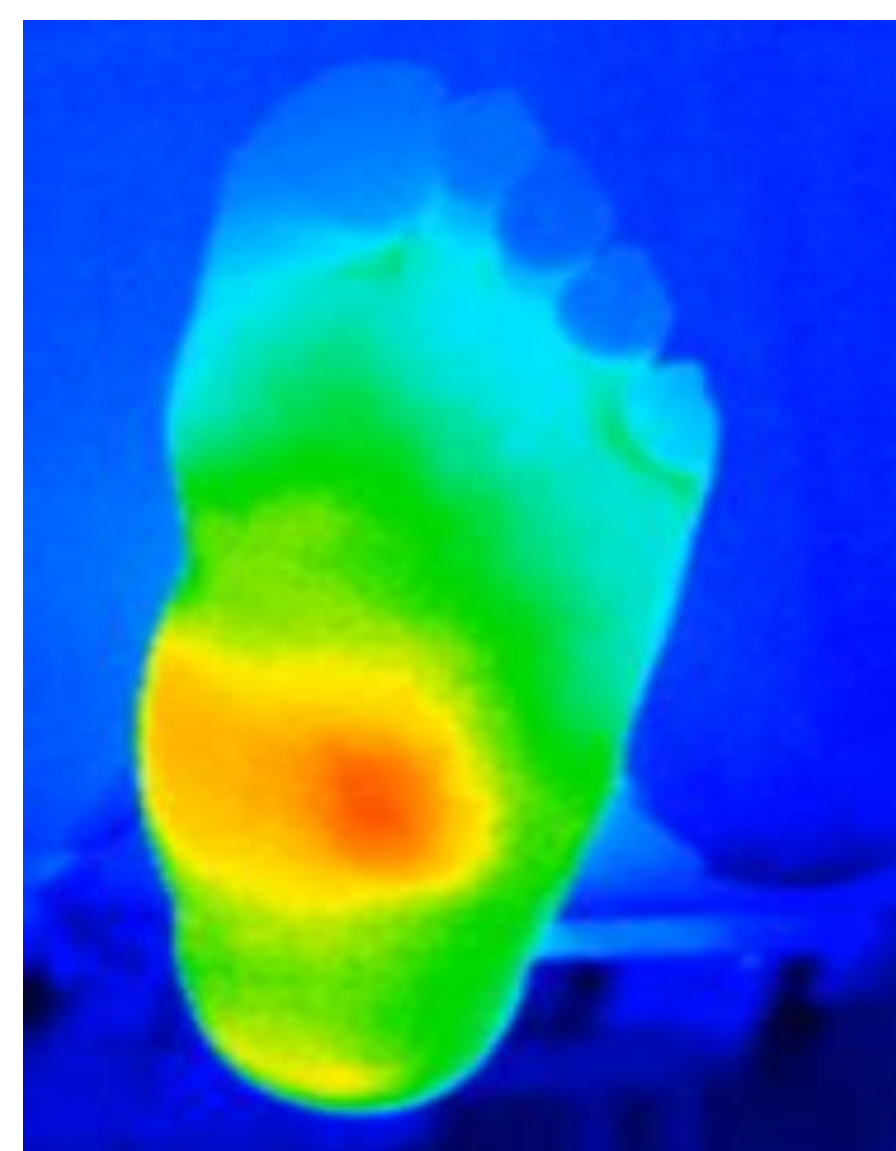
### 4. Extreme Temperatures<sup>6</sup>

A deviation from expected average temperatures in hot (inflammation) spots or cold areas (tissue hypoxia).

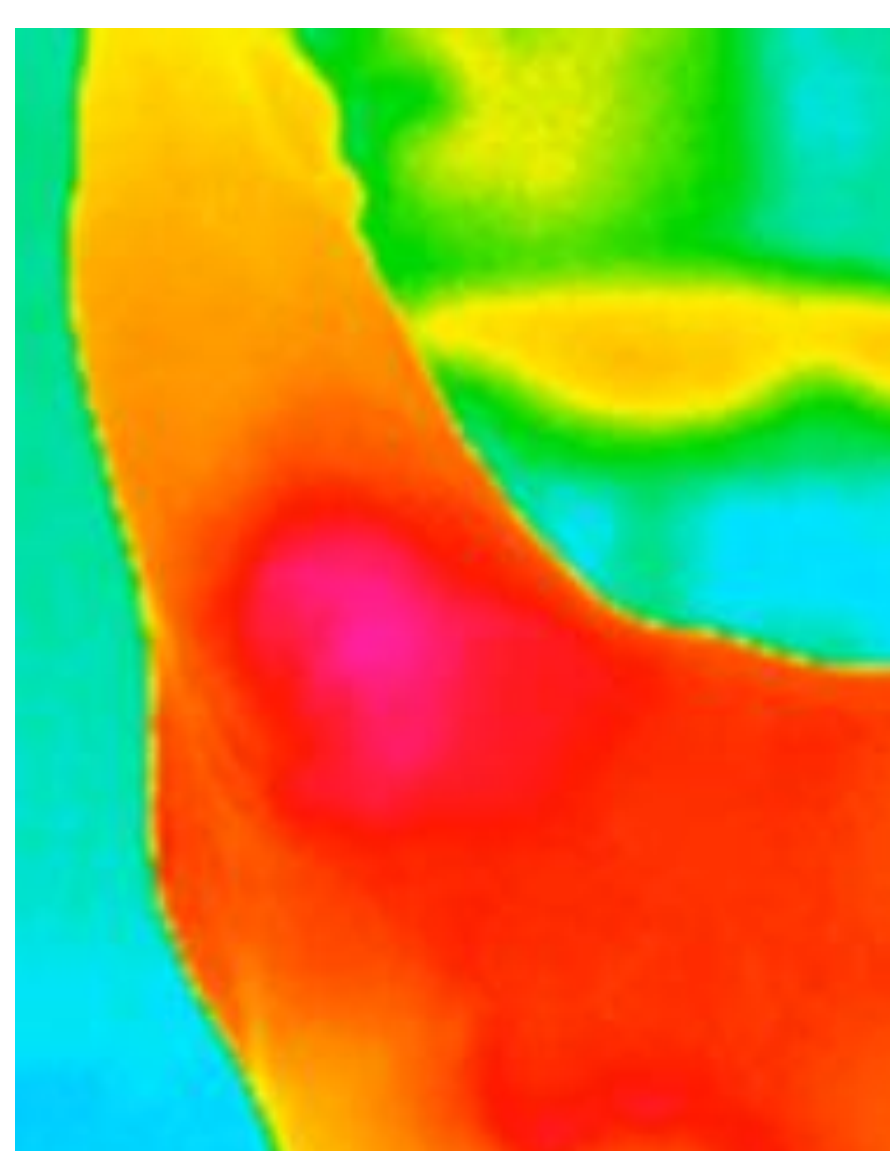
## Examples



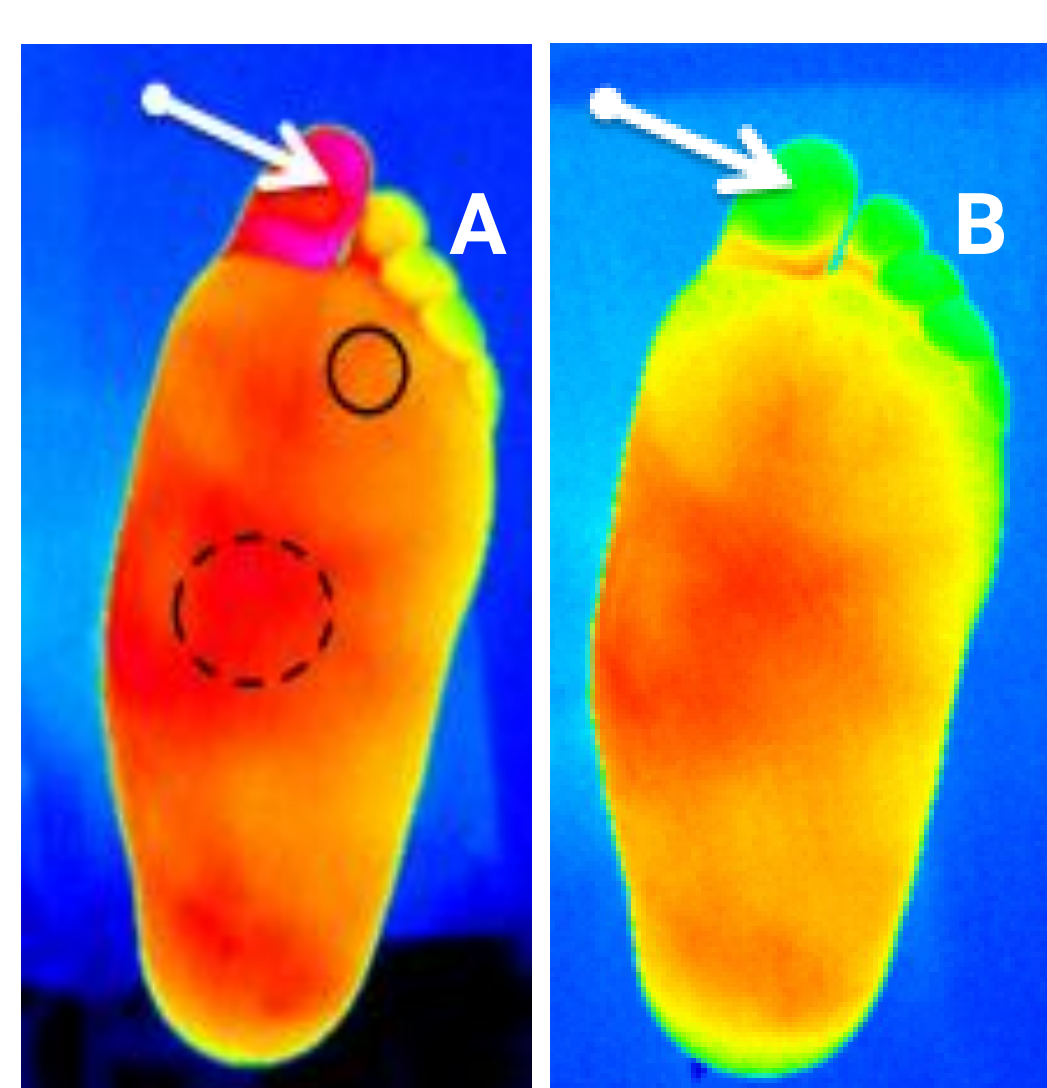
Tissue hypoxia



Charcot foot episode



Pre-ulcer



Involuted toenail (A) before and (B) after treatment

Images courtesy of N. Petrova (King's College, London) and A. Macdonald (Newcastle upon Tyne Hospitals NHS Trust)

## Summary

Foot temperature assessment can be a powerful tool in the hands of clinicians. It provides information about blood perfusion and inflammatory processes of skin and underlying tissue and has the potential of being a useful adjunct in the diagnosis and early detection of a large variety of foot complications.

However, foot temperature patterns are only a secondary indicator of underlying conditions. Temperature itself is not specific and on its own it is not sufficient to arrive at a diagnosis.

## References

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