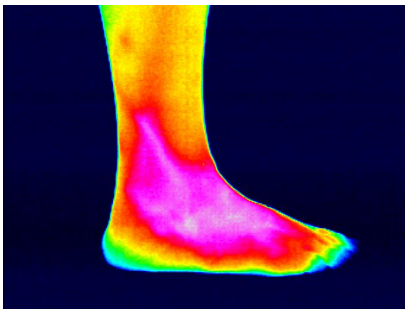
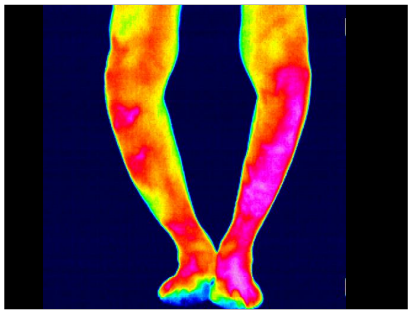
Infra-Red Thermography

This technique allows us to map a patient's skin temperature distribution. The measurements are made in a temperature-controlled room, where the patient rests for 15 minutes to acclimatise before measurement. Electronic images are then taken using a thermal imaging camera. This detects the infra-red radiation which all objects emit continuously. The radiation detected depends on the temperature of the surface viewed and the images are colour-coded to show the temperature distribution. Lower temperatures appear as blues and higher ones as red, pink or white.

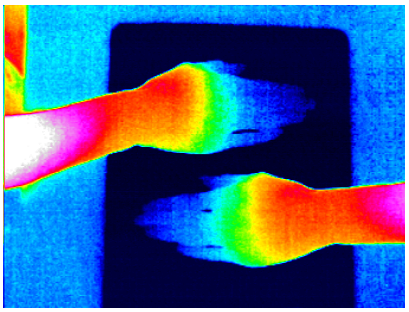
Skin temperature is affected by a variety of rheumatological conditions; anything which changes skin blood perfusion will affect the temperature pattern observed. Although the camera only measures to a depth of about 1mm, deeper blood flow changes can also affect the skin temperature pattern as the heat diffuses outwards. The non-invasive nature of thermography makes it particularly suitable for use with children and for repeated measurements. Here are some examples of thermography's applications.



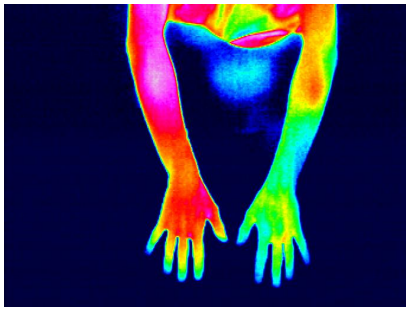
Inflammation of joints can be quantified by measuring the mean temperature of the overlying skin. The result is expressed as a Thermographic Index, the value of which increases with increasing temperature. This is highly correlated with the degree of inflammation. Inflammatory changes in the skin can also be imaged, leading to applications in dermatology, for example assessment of areas of morphoea.



Paget's disease of bone involves accelerated bone growth with a corresponding increase in blood flow to the bone during the active phases of the disease. In bone sites close to the skin surface, such as the tibia, radius and skull, heat diffuses to the surface and the skin temperature can be used to monitor disease activity and the effect of treatment. This is a case where the technique is sensitive to an internal temperature change although only the surface temperature is measured.



The quality of peripheral circulation may also be assessed. In Raynaud's phenomenon finger temperatures recover poorly from exposure to a cold environment. To asses this, a baseline thermogram is recorded. The hands are then covered by thin plastic gloves and immersed in water at 20°C for one minute. The temperatures are recorded 10 minutes later and compared with the baseline values. An index derived from these temperatures quantifies the severity of Raynaud's phenomenon present.

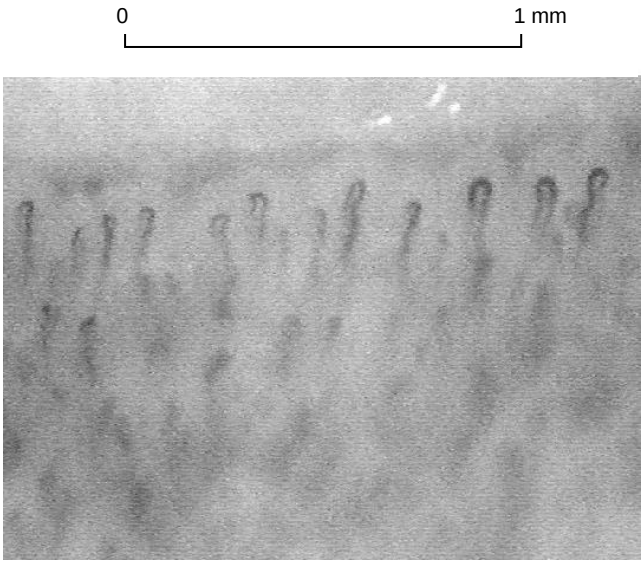


Complex regional pain syndrome, also known as algodystrophy, sympathetic dystrophy or Sudek's atrophy, results in marked asymmetry of limb temperatures. This may be spontaneous or may follow trauma. These temperature differences may be monitored by thermography.

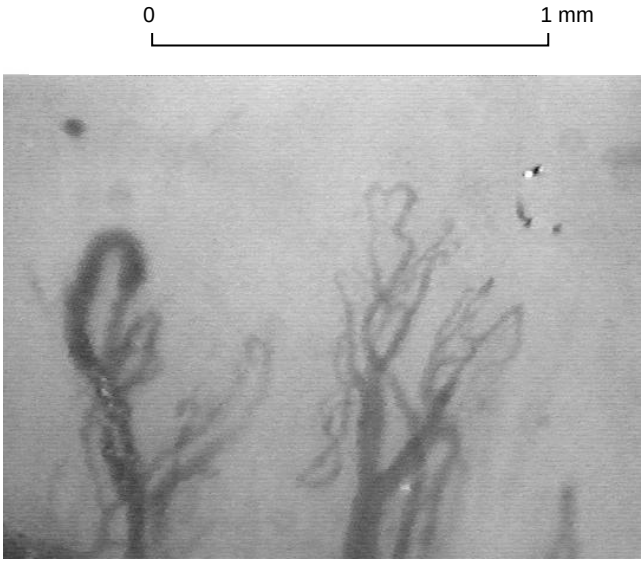
Nailfold Capillary Microscopy (Capillaroscopy)

Patients with connective tissue diseases including dermatomyositis, scleroderma and systemic lupus erythematosus, demonstrate changes in the nailfold capillaries. These include increases of capillary diameters, reduction in capillary numbers, increased visibility of the vascular bed, bushy and bizarre shapes, cuticular forms and punctate haemorrhages. These changes are statistically related to particular kinds of connective tissue disease.

Capillary microscopy allows these changes to be investigated. The nailbed of a finger is painted with liquid paraffin oil, which enables the capillaries below the skin surface to be seen. It is then placed under an optical microscope and images of each section of the nailbed are digitally recorded. Image processing techniques allow enhancement of the images, to optimise capillary visualisation.



Normal capillaries



Dermatomyositis