THERMIDAS

How can thermal imaging help physical therapists?

New business and more motivated patients for rehabilitation with thermal imaging



Portable solution for daily screening

System benefits

- 384 x 288-pixel thermal imager
- 120 degrees rotating camera for best imaging angle and optimised ergonomics
- Large 10", HD screen provides clinicians with clear images for analysis
- ROI (region of interest) marking tools for
  - Temperature differences on screen
  - Up to 4 pairs can be added to every image
- Online image bank with automated image retrieval for active patient



Portable solution for daily screening

- The IRT-384 is a convenient infrared-enabled tablet that is designed for daily screening of patients.
- The high-resolution IR imager quickly highlights temperature differences in skin areas.
- Can also be used in monitoring these differences e.g. in rehabilitation.



Our solution for prosthetics





Unique system benefits

- 120 degrees rotating camera for best imaging angle and optimised ergonomics
- Big 10” screen, no need to transfer images to a PC before analysis
- ROI (region of interest) marking tools for
  - Temperature differences on screen
  - Up to 4 pairs can be added to every image
- Online image bank with automated image retrieval for active patient -> easy progress monitoring

Thermidas IRT-384 Tablet	
Operating system	Android
Dislay type and size	TFT, 263 mm (10,4")
Display resolution and colours	1920 x 1200 and 16 M
RAM and ROM	4 GB and 64 GB
CPU type and speed	Octa-core Snapdragon 670
SIM	2G/4G(FDD+TDD)
Connectivity	3,5mm; USB-C; Wi-Fi, Bluetooth, GPS
Thermal camera resolution	384 X 288
Weight	1300 g

Recommended solution

The IRT-384 Tablet is an all-in-one thermography solution for daily imaging. Locate possible problem areas quickly, monitor the effectiveness of treatment, and use the thermal images to motivate the patient.





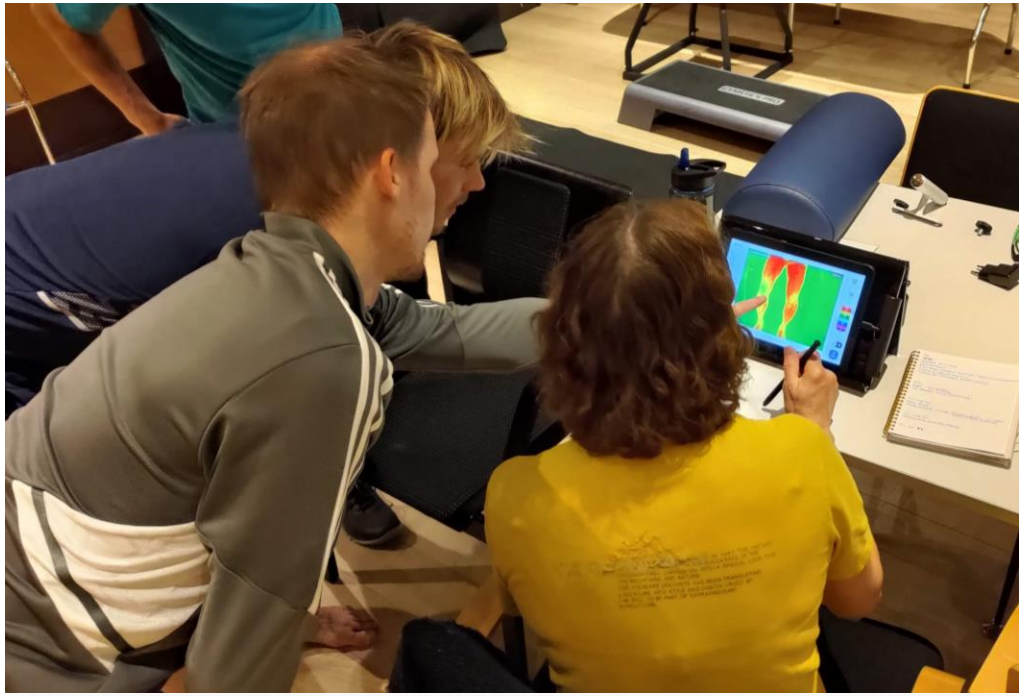
- 120° rotating camera for best imaging angle and optimized ergonomics
- Large 10” HD screen making instant analysis possible using the tablet
- ROI (Region of Interest) tools for temperature differences with up to 4 comparison pairs
- Online image bank with automated image retrieval for active patient

© Thermidas Oy

Thermal imaging in physical therapy

The routine use of thermal imaging provides a simple and easy solution to the practice of predictive medicine. By integrating this screening tool into your wellness and recheck visits, you can:

- Generate additional income
- Localize and detect injuries faster
- Delivers more targeted treatments
- Motivate clients with visual updates on treatment progress, as thermal imaging is an objective means of monitoring the effectiveness of rehabilitation interventions

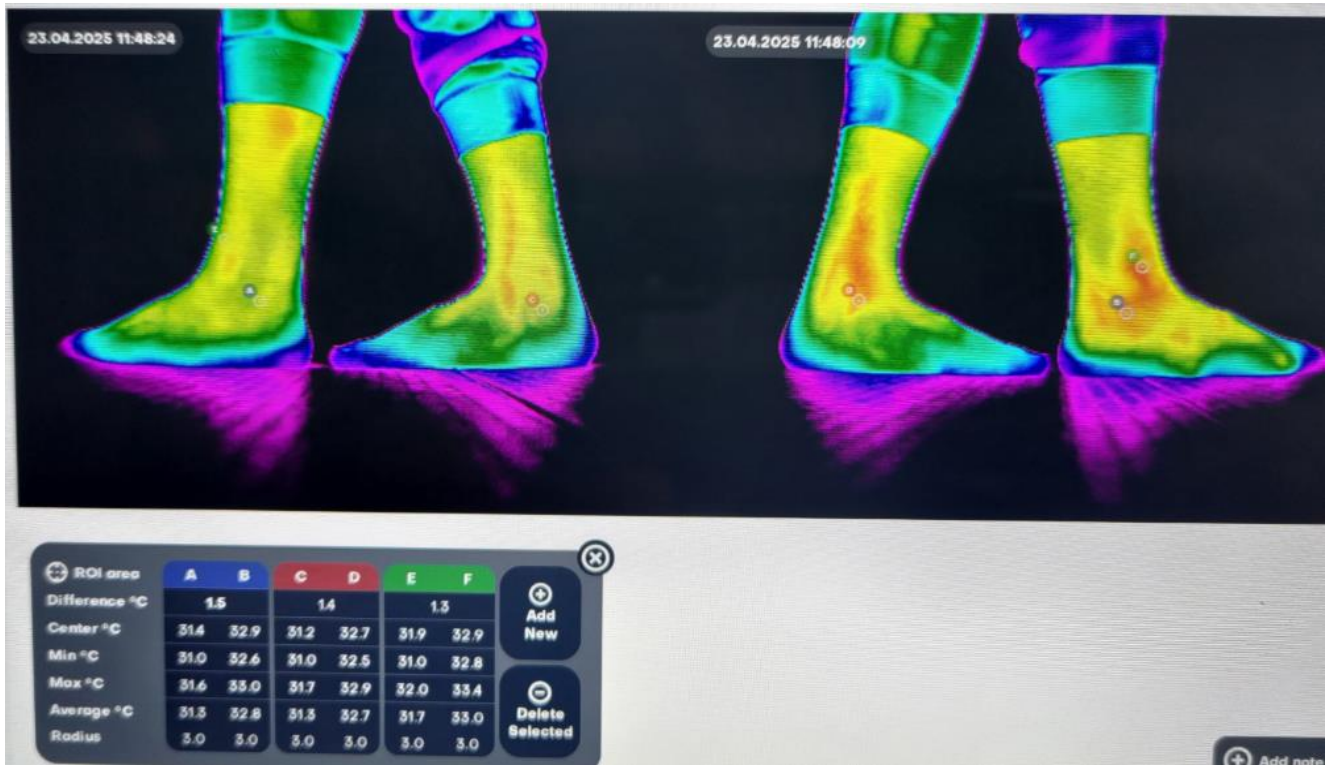


© Thermidas Oy

Injury Detection and Monitoring

IRT can detect changes in skin temperature, which often indicate underlying issues **such as inflammation, muscle strain, or nerve dysfunction**. By identifying these thermal asymmetries, physiotherapists can pinpoint areas that may require treatment before more obvious symptoms, like pain, appear [1] [2].

More about this case in a later slide



A sprained ankle

(1) Fernández-Cuevas, I. et al. (2017). Infrared Thermography for the Detection of Injury in Sports Medicine. DOI:10.1007/978-3-319-47410-6_4

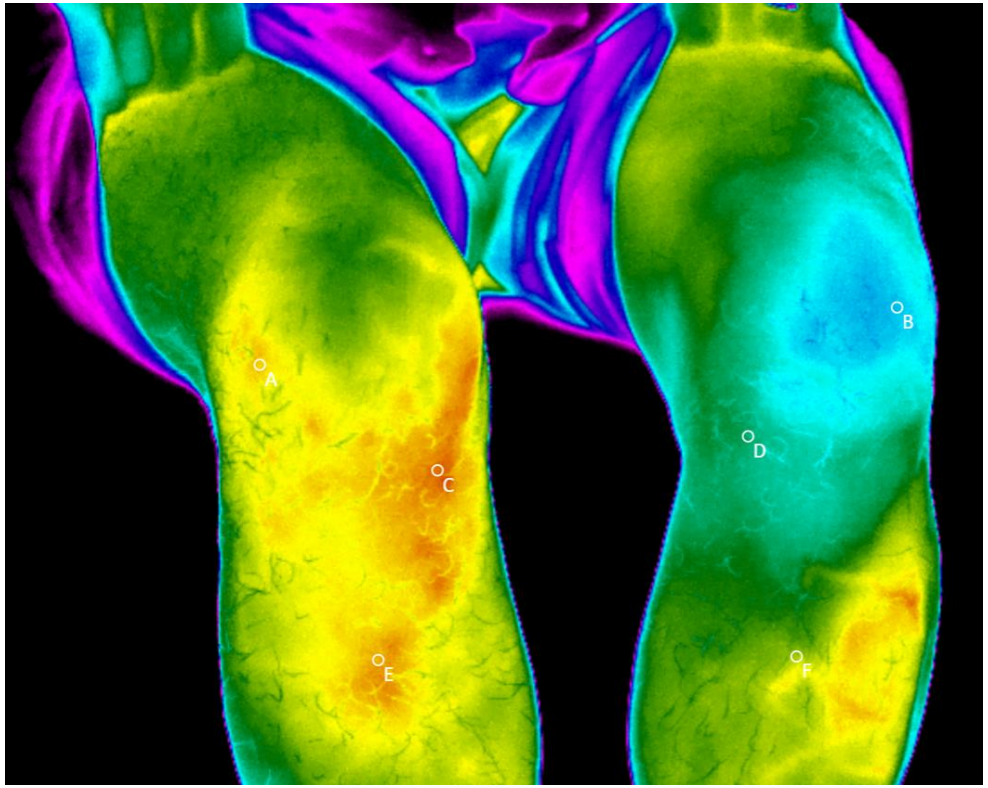
(2) Ramirez-GarciaLuna, J. et al. (2022). Thermography in Wound Care, Surgery, and Sports Medicine: A Review. DOI:10.3389/fphys.2022.838528

© Thermidas Oy

Non-Invasive and Quick

Thermography is a **non-invasive** method that provides **immediate results**. This allows physiotherapists to quickly assess a patient's condition without the need for more invasive procedures. (1)

Patient with a torn meniscus

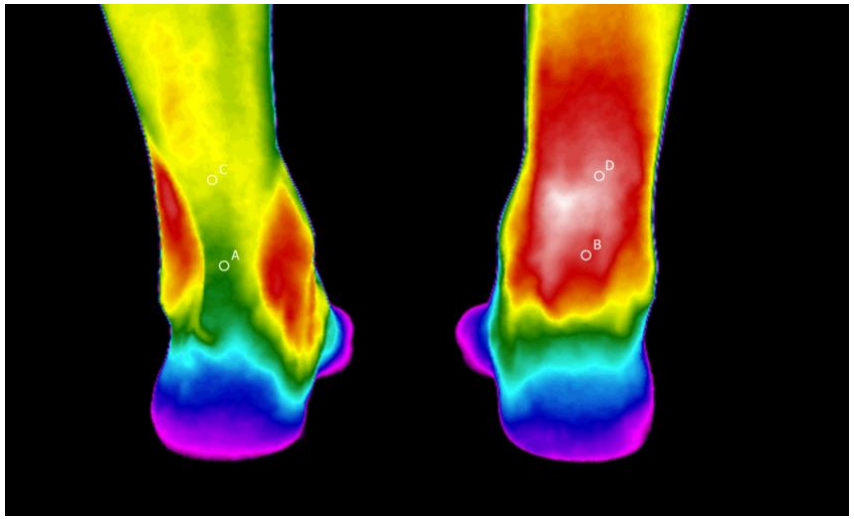


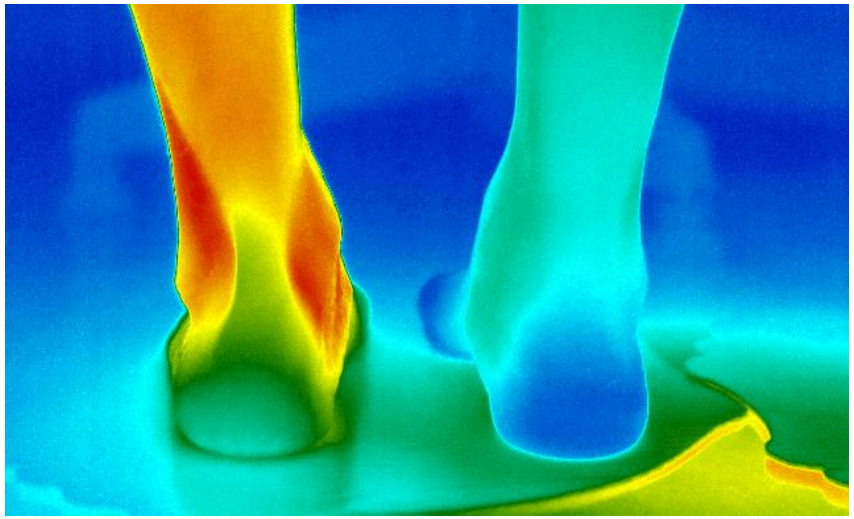
(1) Fernández-Cuevas, I. et al. (2017). Infrared Thermography for the Detection of Injury in Sports Medicine. DOI:10.1007/978-3-319-47410-6_4

© Thermidas Oy

Tracking Progress

By regularly using thermography, physiotherapists can monitor the effectiveness of treatments over time. Changes in thermal patterns can indicate **how well a patient is responding to therapy**, helping to adjust treatment plans as needed [2].





Broken and operated Achilles tendon

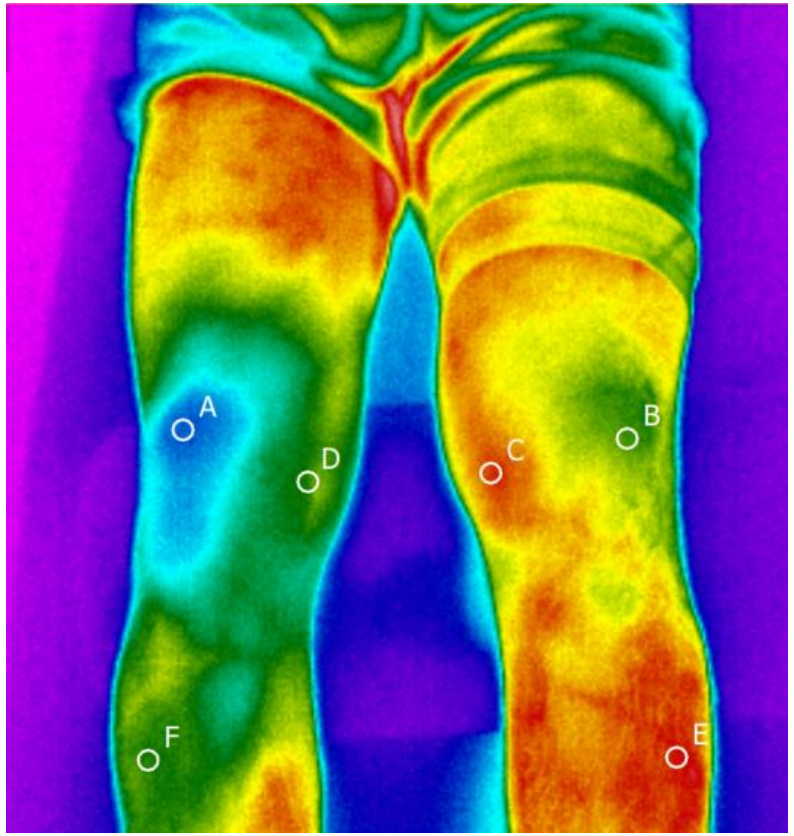
- First image 8 hours after orthosis removal
- Second image after six weeks of intense rehabilitation.
- Blood flow restored but still a lot of healing ongoing (local inflammation creates heat)

(2) Ramirez-GarciaLuna, J. et al. (2022). Thermography in Wound Care, Surgery, and Sports Medicine: A Review. DOI:10.3389/fphys.2022.838528

© Thermidas Oy

Personalized Treatment Plans

The detailed thermal images help physiotherapists to create more personalized and targeted treatment plans. By understanding the specific areas of inflammation or muscle activity, they can **tailor their approach to each patient's unique needs**.



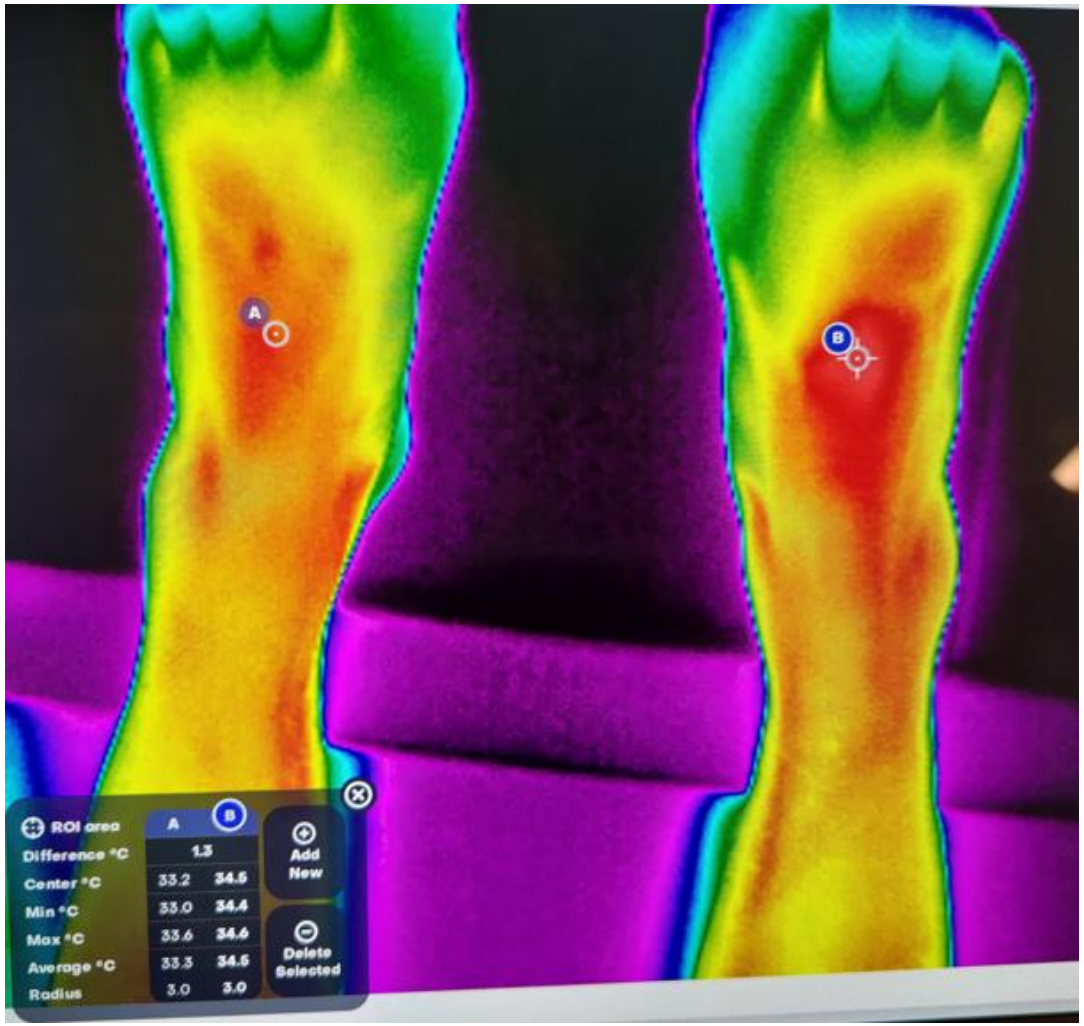
A fresh ACL injury

- A football player got injured during a game
- The patient could not activate their *vastus medialis* during a wall sit test
- Thermal images used to confirm the diagnosis and support the selection of the correct treatment path

© Thermidas Oy

Personalised Treatment Plans, Case Sprained ankle

- A national team basketball player injured his ankle during a practice session.
- A thermal image was taken two days after the injury, which clearly showed an elevated temperature of 1.3 degrees on the injured side.
- Physiotherapist ordered a week long training break and monitored the injury with thermal imaging
- After two weeks the temperature difference was below 1 degrees and the player could resume team training with ankle support
- Thermal imaging was continues to prevent overuse and maximise the healing of the ankle



© Thermidas Oy

Preventive Care

Thermography can be used to prevent injuries by **identifying areas of the body that are under stress or at risk of injury**. This proactive approach helps in implementing preventive strategies, reducing the likelihood of future injuries [(1)].

Stress fracture in the left foot

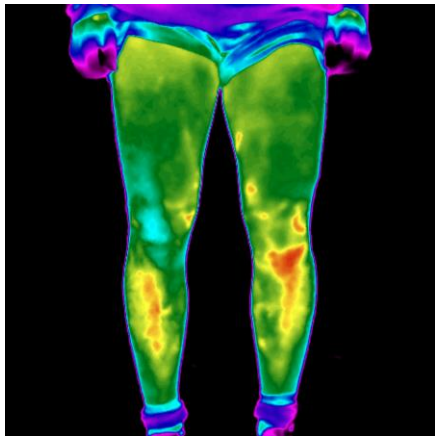


(1) Fernández-Cuevas, I. et al. (2017). Infrared Thermography for the Detection of Injury in Sports Medicine. DOI:10.1007/978-3-319-47410-6_4

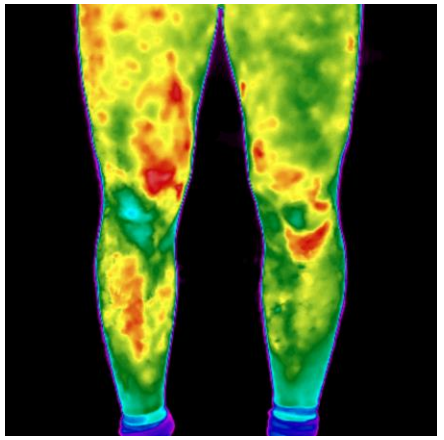
© Thermidas Oy

Knee injury and rehabilitation

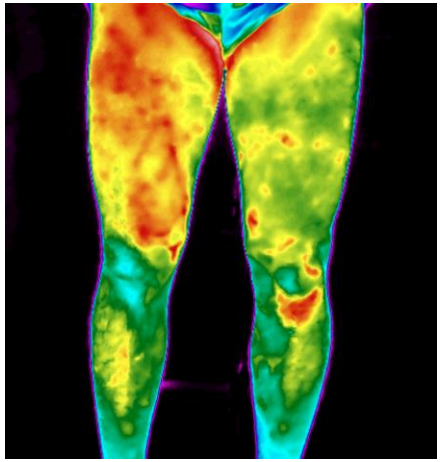
- Professional hockey player's left knee ligaments damaged
- Thermal images taken six months after trauma to the knee and reconstructive surgery
- The right side gets warmer under stress because the patient compensates with the healthy leg
- Despite compensation, the left leg gets warmer under stress around the site of the injury



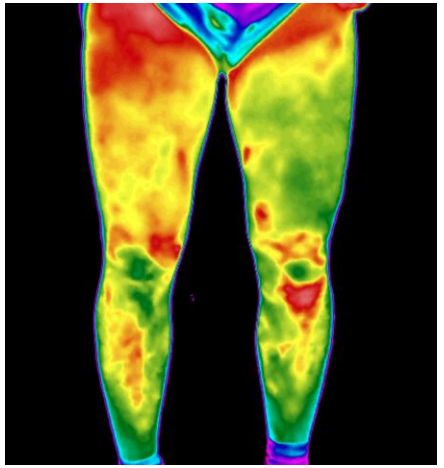
1. Initial state



2. After bike test



3. After wall sit test

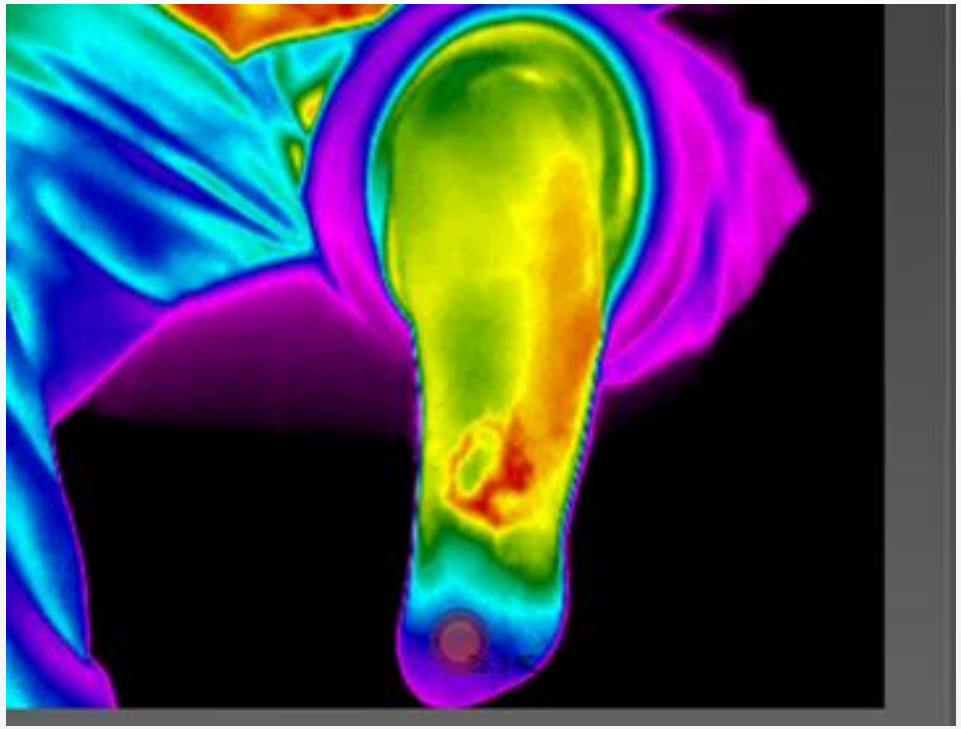


4. Rest

© Thermidas Oy

The benefits of thermal imaging

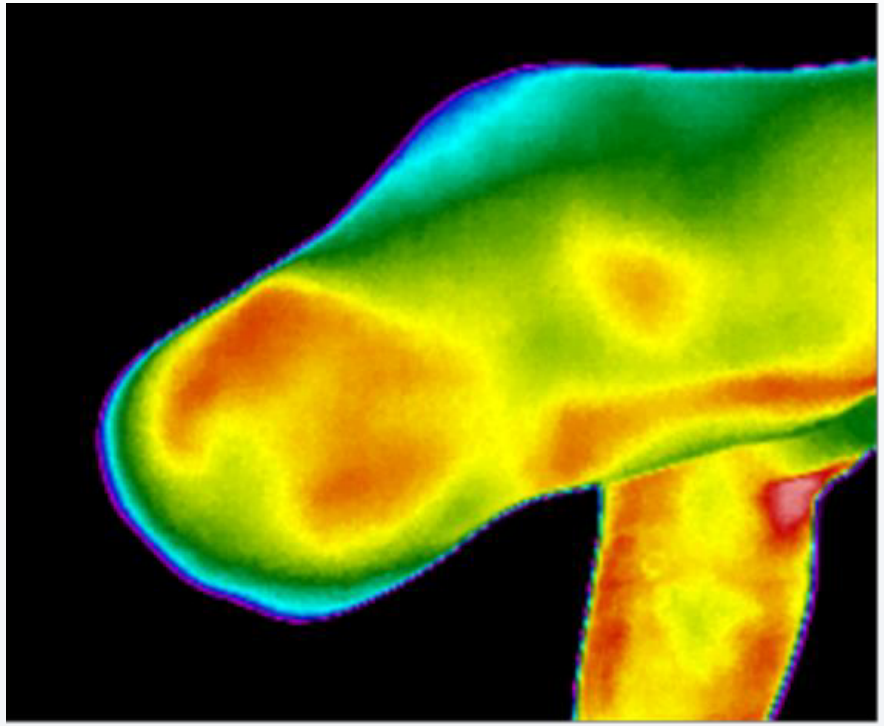
- Taking advantage of thermography will allow a quick and easy detection of abnormal body temperatures indicating underlying pathologies, such as
  - Inflammation
  - circulatory issues,
  - and possible ulcerations.
- Patient friendly
- Non-invasive, non-contact
- No exposure to radiation
- Immediate results



The benefits of thermal imaging for prosthetics

The quantitative measure of the state of the residual limb perfusion which is revealed by thermal maps may provide important information about:

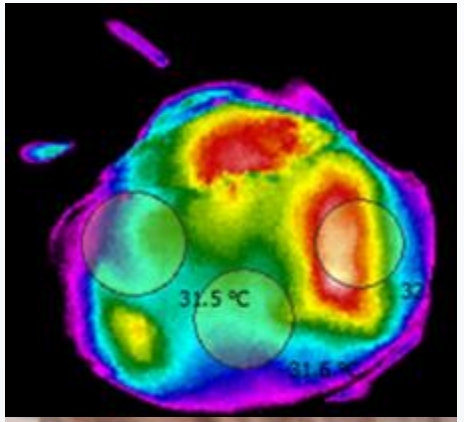
- Existing defects of the socket, that during walking translate into excessive forces and in turn temperature increase;
- Skin inflammations, e.g., as the result of the liner leading to excessive humidity and heating;
- The classification and treatment of phantom limb pain.



*Cutti, Andrea G., Paolo Perego, Marcello C. Fusca, Rinaldo Sacchetti, and Giuseppe Andreoni. 2014. "Assessment of Lower Limb Prosthesis through Wearable Sensors and Thermography" *Sensors* 14, no. 3: 5041-5055. https://doi.org/10.3390/s140305041

Thermography can support the study of the stump and the clinical decisions for:

- Adjusting the socket design
- The localization of painful points to support the physician in the definition of analgesic therapy (e.g., laser therapy, capacitive-resistive-therapy);
- The localization of inflammatory situations supporting the clinician in the custom construction of the socket or in planning for a proper and localized anti-inflammatory therapy;
- The localization of thrombotic phenomena in amputees for peripheral vascular causes, in order to check the status of the limb before and after the prosthesis.

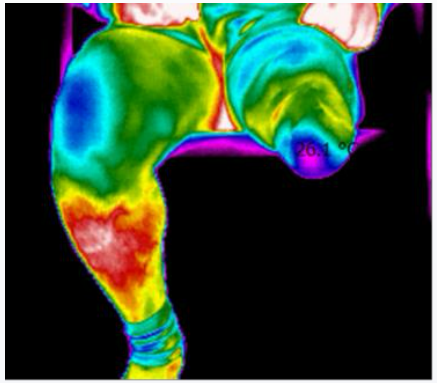
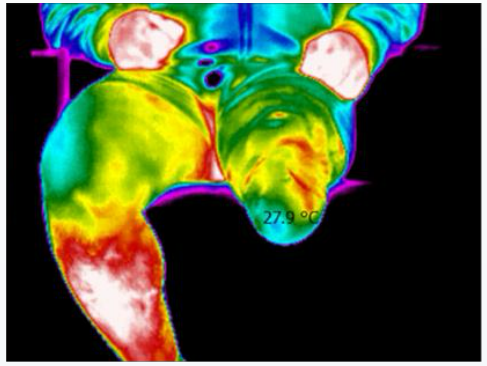
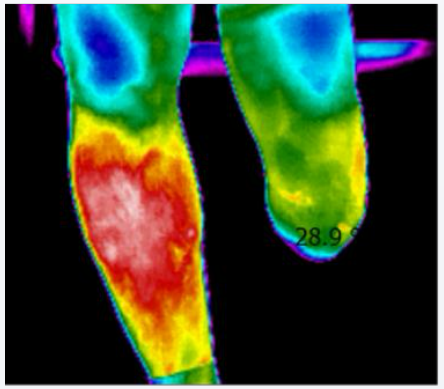
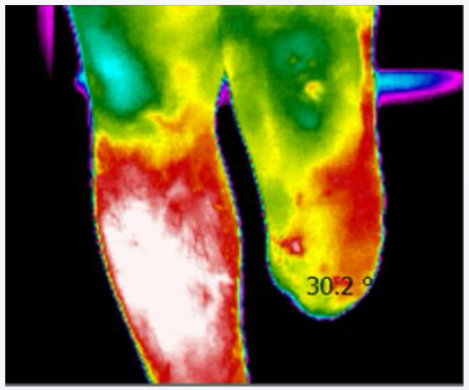




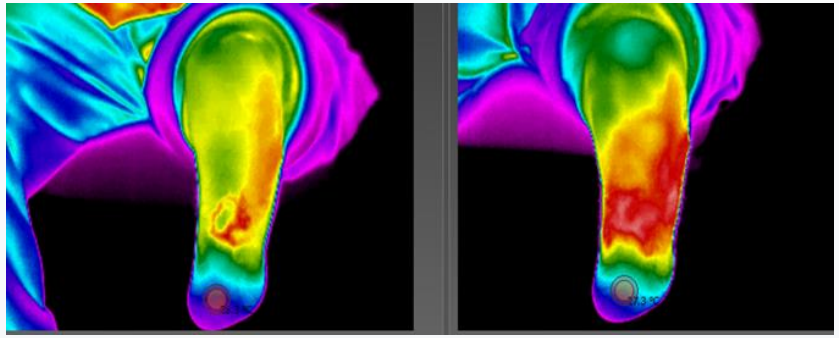
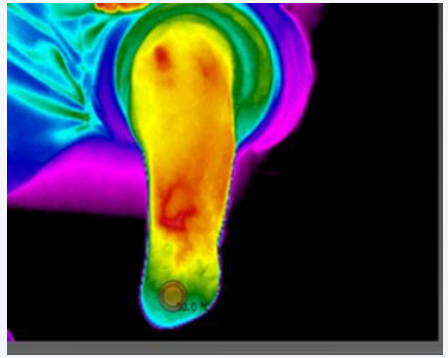
Kristen, H.; Lukeschitsch, G.; Plattner, F.; Sigmund, R.; Resch, P. Thermography as a means for quantitative assessment of stump and phantom pains. *Prosthet. Orthot. Int.* **1984**, *8*, 76–81.

Prosthesis – examples images

- **Pin Lock – Sleeve suspension**

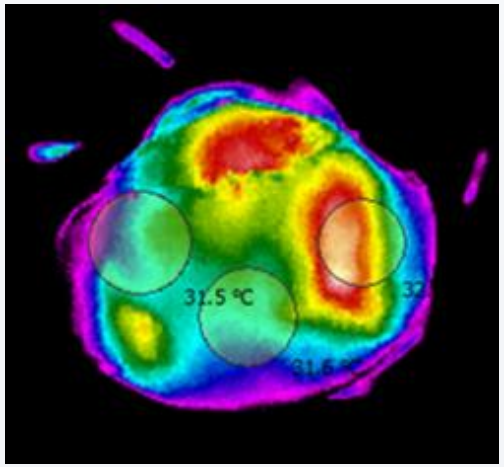





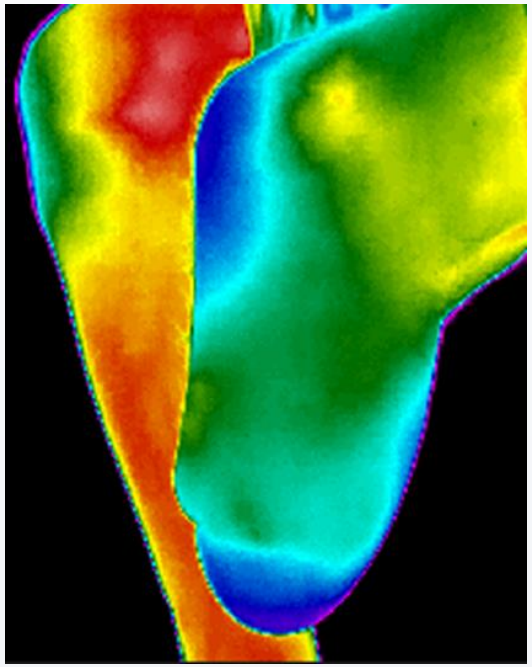
- **Sleeve suspension – Vacuum connection, Harmony.**

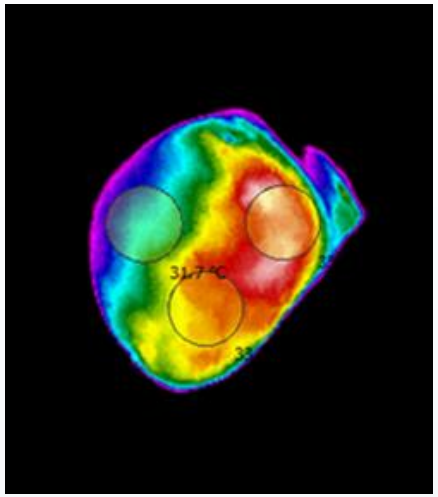



Posterior flap and Skew flap

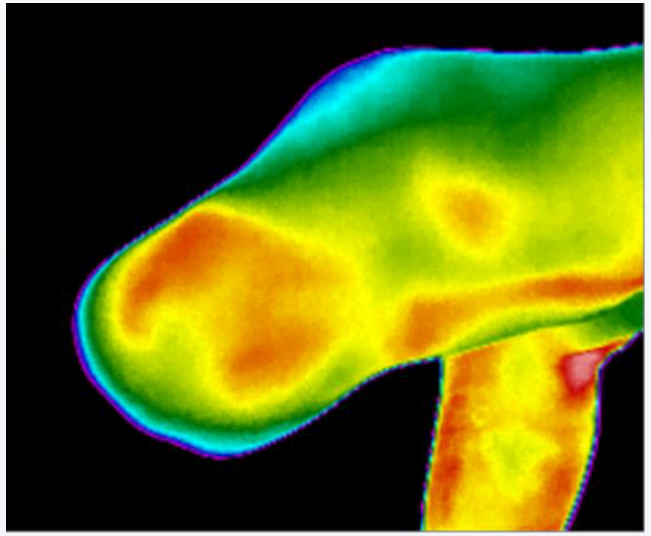




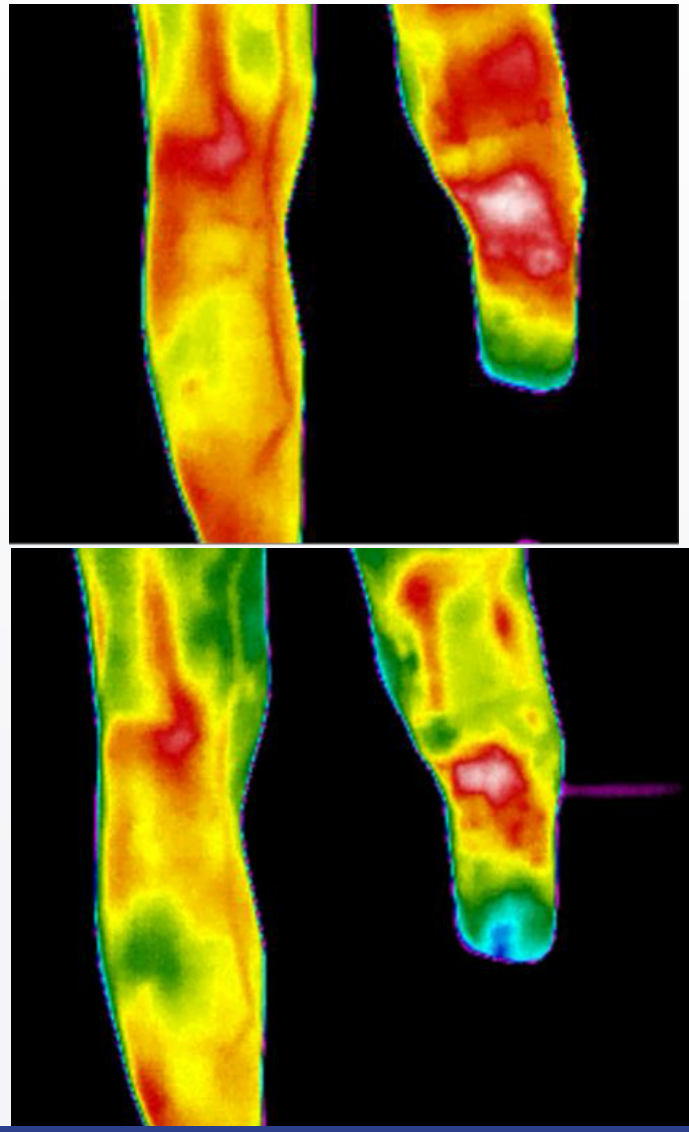


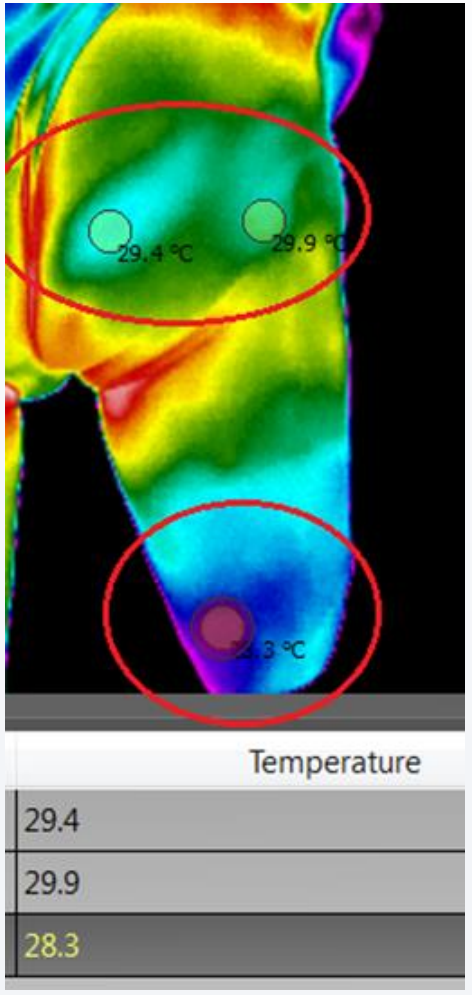


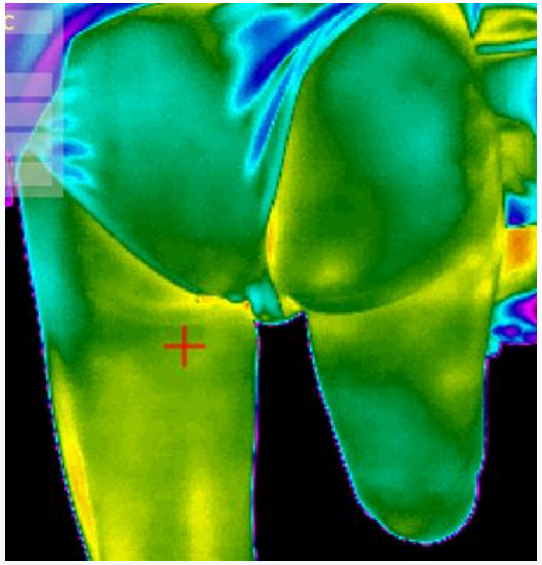




Stump Pain

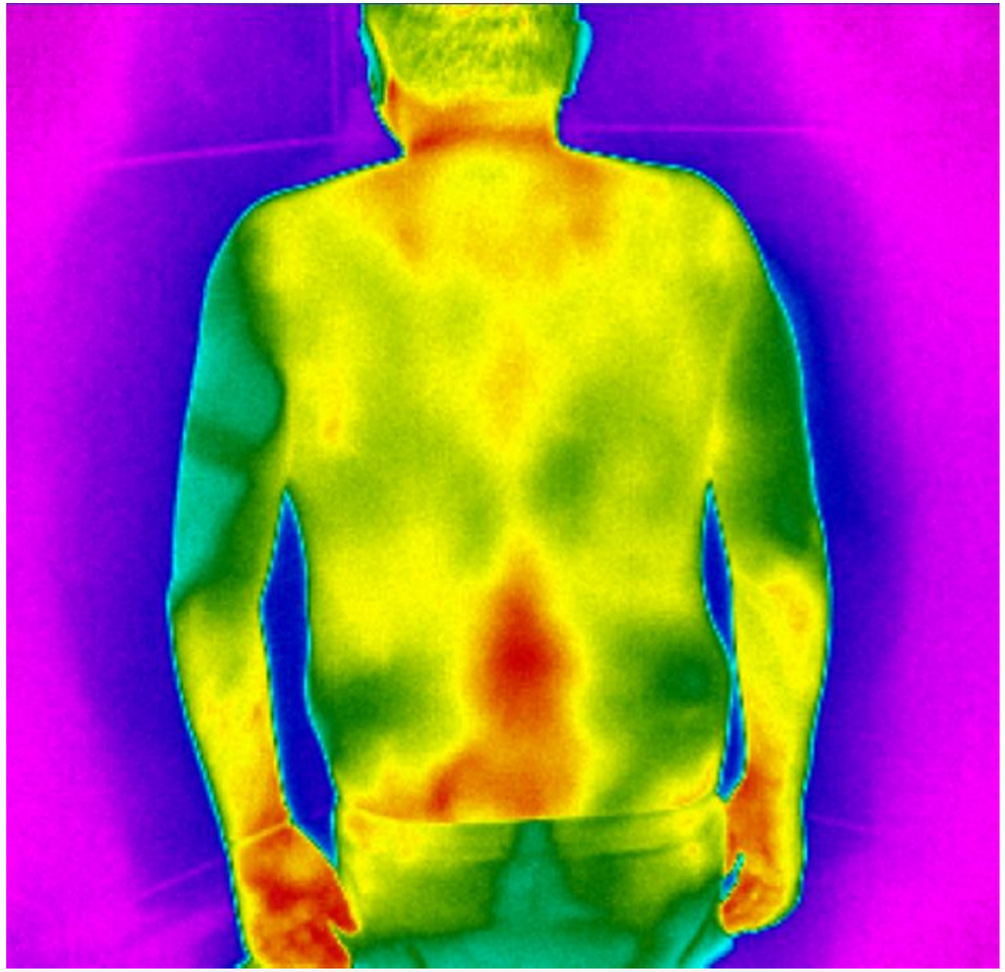






Nerve Pain

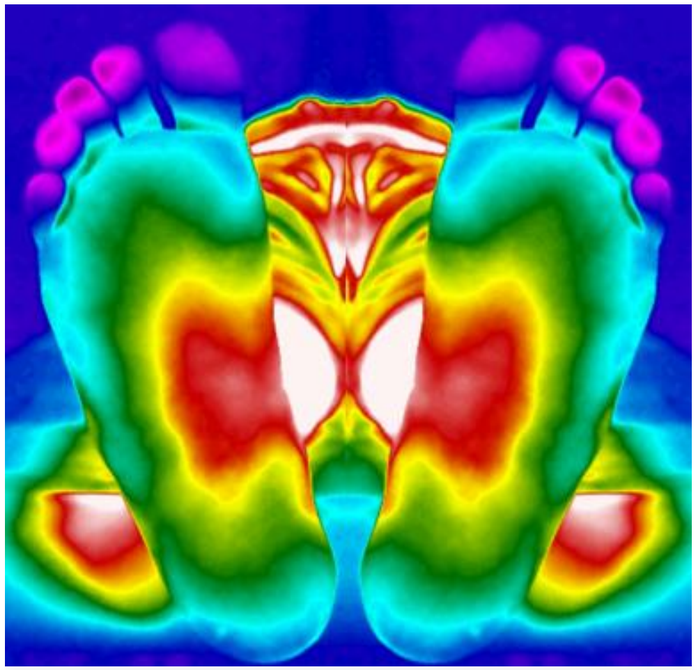
- Pinched nerve between the L4/L5 vertebrae
- Pain radiates to the left side.



Neuropathy



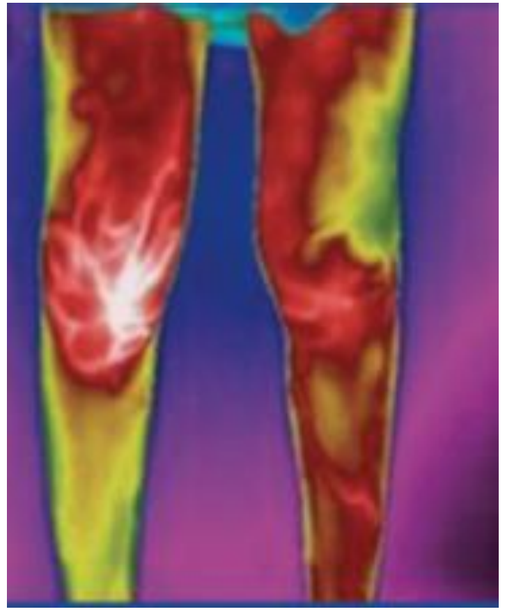




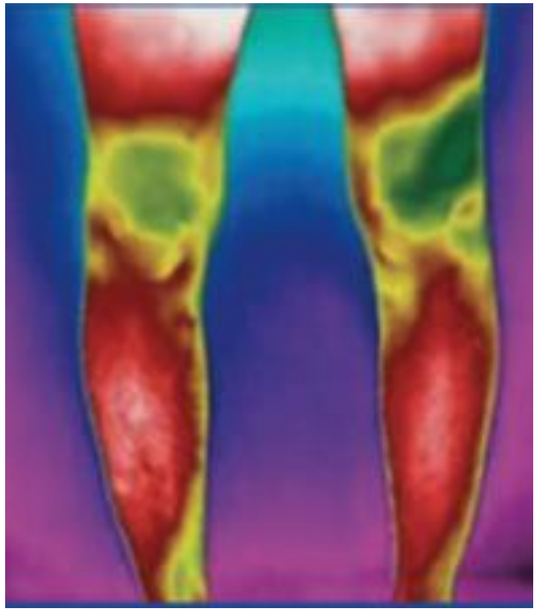
- Healthy feet have a ”Butterfly Wings” shaped thermal pattern (Image on the right)
- Neuropathic feet have often ”Leopard skin” shape thermal pattern.
- Toes are hot and thermal pattern is non-symmetrical

Joint Inflammation

- Increases or decreases in temperature have a direct relation with aggravation or reduction of inflammation
- IRT will detect sub-clinical inflammation (not detectable by clinical examination)
- IRT will aid clinicians during clinical examination of the inflammation
- IRT has high sensitivity and specificity and is effective in the detection of positive inflammation with low false positives and negatives



Knees of Rheumatoid Arthritis Patient

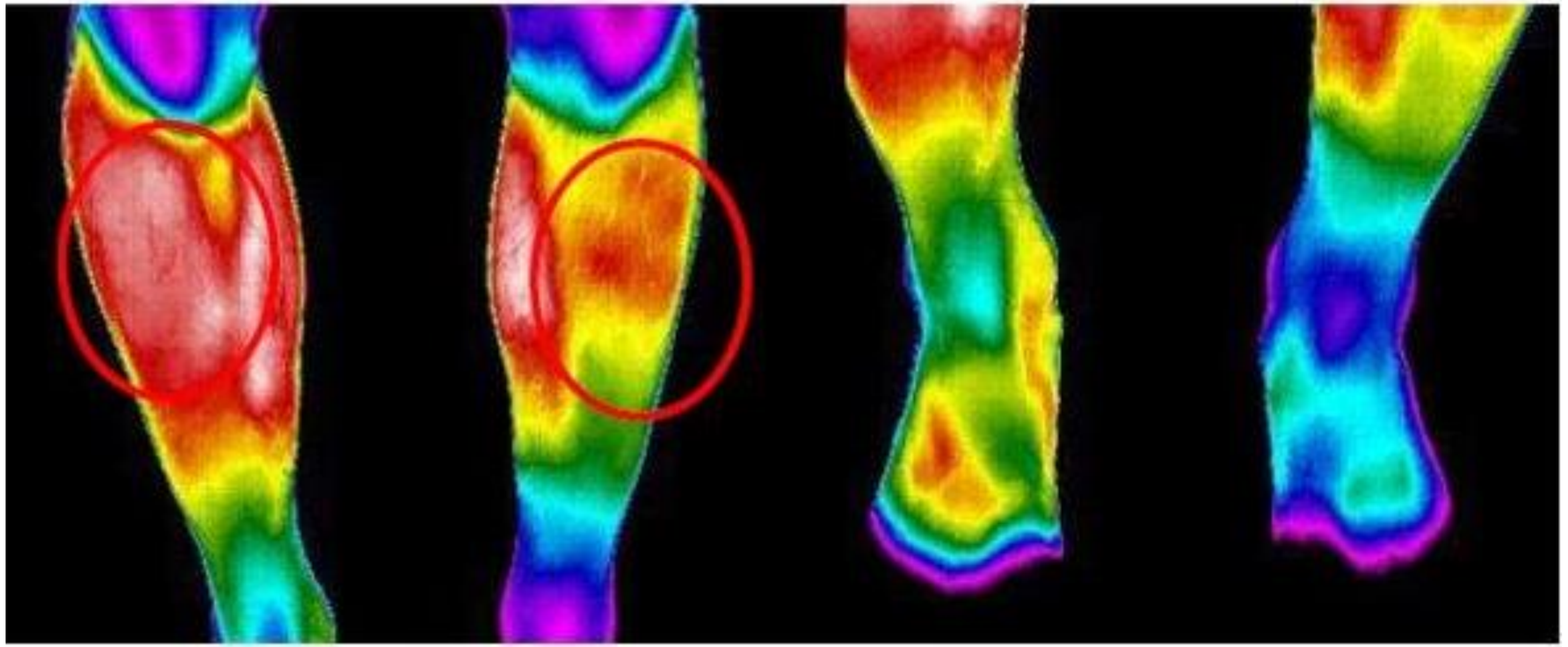


Knees of normal subject

Infrared imaging is a very sensitive tool for the detection of inflammation of joints and is very useful for detection of subclinical inflammation of joints

Nath et al, 2022, Role of Infrared Imaging for Detection of Subclinical Inflammation of Joints: A Prospective Cohort Study

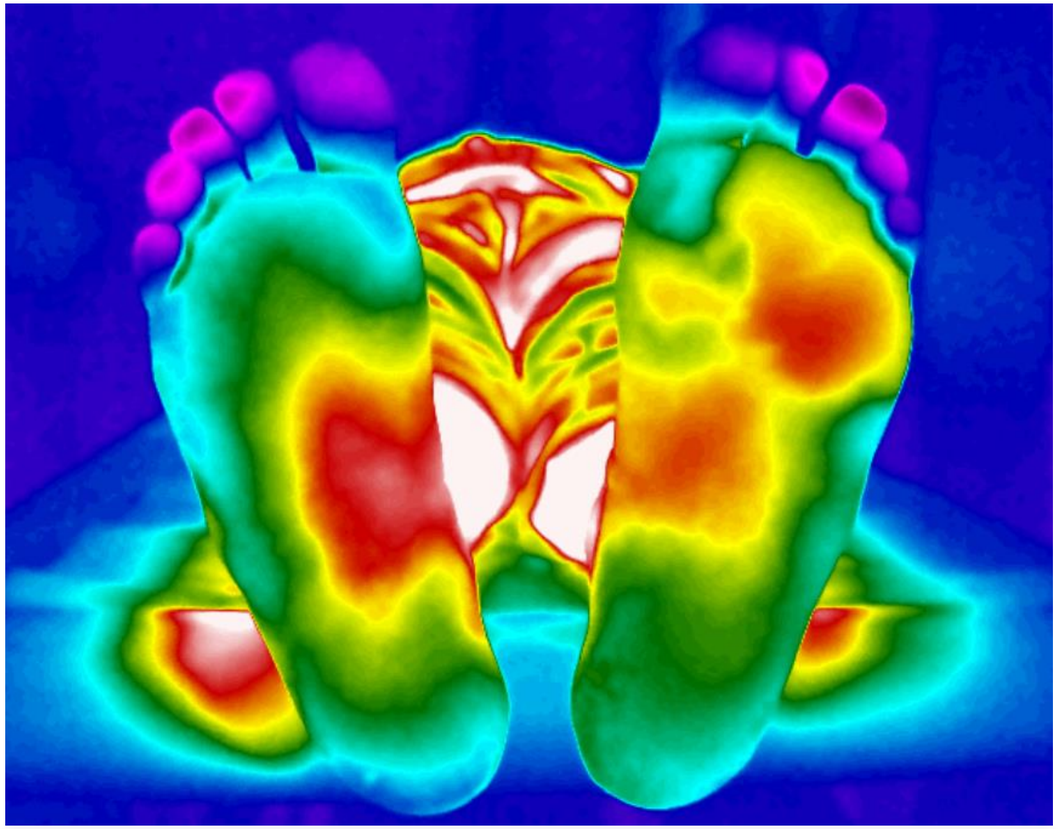
Sciatica Pain



- Sciatica pain becomes visible
- Pain is best seen in the colder right ankle

Osteoarthritis

- Unsymmetrical temperatures of the feet were discovered during a thermal imaging session
- Later diagnosed as Osteoarthritis in the MTP joint of the left hallux



Pain

- The patient had previously had back surgery
- Complained of gluteal pain
- The pain is visible in thermal images in the left buttock
- Thermal image confirms the patient’s story and help the doctor to decide the next steps

