Title (?): Angiosomal interpretation of dermal thermometry in patients at high risk for diabetic foot ulcers

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Background

As part of a comprehensive strategy for limb preservation in high risk populations, remote temperature monitoring has emerged as a useful modality for detecting the inflammation that precedes ulcer formation. The practice involves daily measurement of temperature asymmetry between 6 contralaterally matched key-point locations: hallux, 1st metatarsal head, 3rd metatarsal head, 5th metatarsal head, arch, and heel. While the efficacy of thermometry is well-established, guidance on more nuanced clinical interpretation of the foot temperature data is needed, which may enable tailored offloading interventions. Thus, the concept of angiosomes may provide a framework for interpreting temperature data.

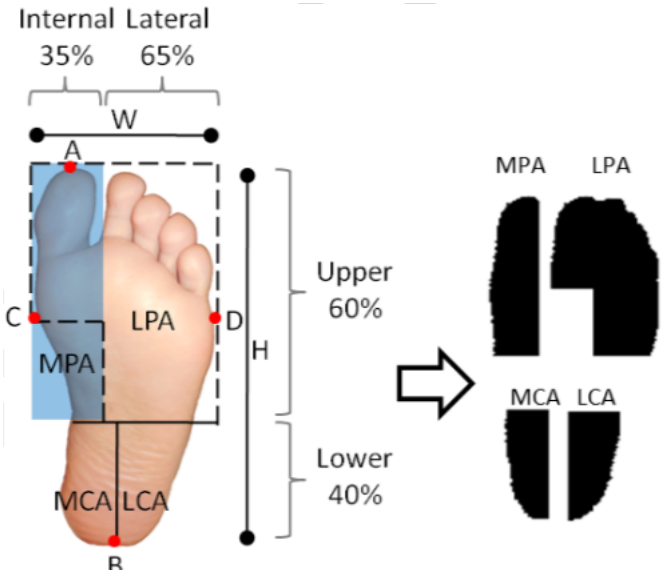


Figure 1. Angiosome distribution of the plantar foot

Methods

In a multi-center trial (NCT02647346), 129 participants with a history of diabetic foot ulcer (DFU) were followed with a remote temperature monitoring mat for 34 weeks. The details of all DFU occurring during participation, including location, date presented and healed, were collected, as well as high-resolution temperature maps, or thermograms, for periods in which participants were ulcer free.

Wounds were grouped according to their closest temperature asymmetry location, and wounds to minor digits were grouped separately (Table 1). An aggregate of all thermograms in the two months preceding a wound was compiled, and the 75th percentile temperature differences during that period were examined.

Location	Number of DFU	Number of Patients	Number of Thermograms
Heel	3	3	69
5th Metatarsal Head	6	6	205
3rd Metatarsal Head	8	5	156
1st Metatarsal Head	14	13	546
Hallux	13	13	458
Minor Digits	9	7	347
Arch	0	0	0

Table 1.

Results

The heel, supplied by the medial calcaneal (MCA) and lateral calcaneal (LCA) artery appears isolated from the forefoot (medial plantar [MPA] and lateral plantar [LPA] artery), and wounds occurring at the 5th metatarsal show involvement extending into arch and 3rd metatarsal (LPA). Furthermore, despite being thermally-isolated, the 1st metatarsal head and hallux are highly correlated (MPA), which suggests shared blood flow.

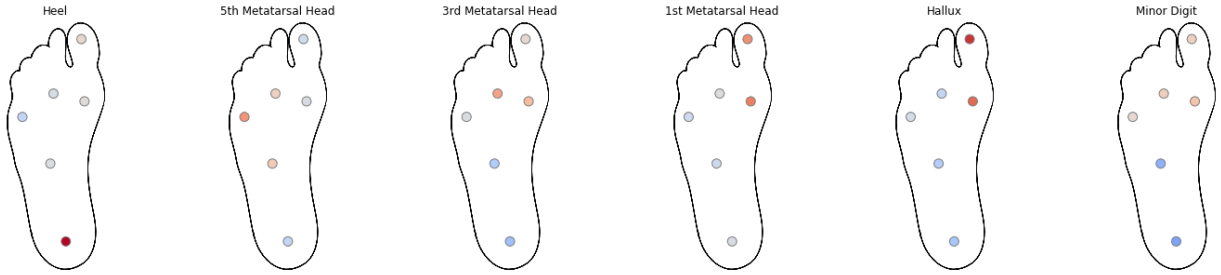


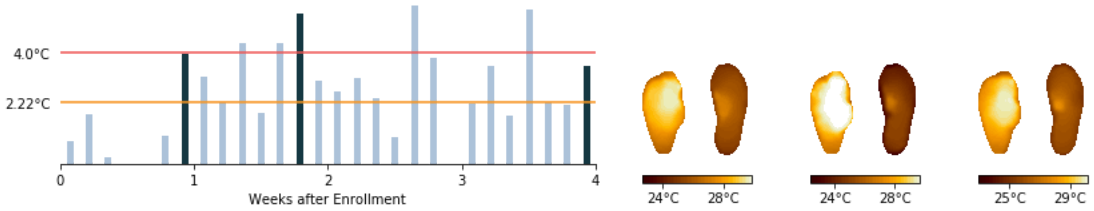
Figure 2.

Conclusion

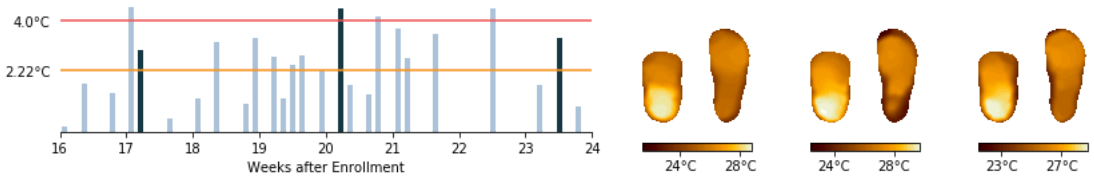
In a novel approach to preventing foot ulcer recurrence, wireless technology has emerged that can detect temperature asymmetry between corresponding sites on the plantar foot, and direct early intervention. Previous studies have demonstrated the efficacy of thermometry, however, the question of whether inflammation, manifested as temperature differences between contralaterally matched key-point locations is correlated with the angiosome model has not been addressed.

Examples

- Example 1
    - 65 y/o male with DM2 (A1c = 7.9%), h/o right Charcot with rocker bottom, h/o right midfoot wound healed day of enrollment
    - trips end of week 1
    - patient presents at end of week 4 with 0.6 x 0.9 x 0.1 uninfected wound to right sub first
    - patient reported callus and drainage during week 3
    - inflammation throughout MPA



- Example 2
    - 64 yo male with DM2 (A1c = 6.1%) w/ h/o right and left heel DFU and left 1st met head wound, most recent (right heel) healing 1 week prior to enrollment
    - inflammation throughout heel in two months preceding presentation of lateral heel ulcer during week 24, in some scans inflammation localized to LCA



- Example 3
    - 48 yo male with h/o left with DM2 (A1c = 10.8%) and h/o right 1st met head wounds, most recently healed day of enrollment
    - inflammation throughout LPA radiating through midfoot beginning on first scan
    - presents with right lateral forefoot callus and wound upon debridement during week 6