Remote Temperature Monitoring in Diabetic Foot Ulcer Detection: A Case Series

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Introduction

Diabetic foot ulcers (DFU) are known to be associated with increased morbidity, mortality, and resource utilization. A temperature measuring smart mat for the home monitored under the name Podometrics RTM System has been developed for use as a screening device to detect recurrence of DFU prior to clinical presentation, allowing for temperature-guided avoidance therapy. The objective of this study is to illustrate the use of remote temperature monitoring in detection of recurrence in a series of three patients with history of DFU.

A thermometric telemedical mat from Podometrics has been shown to detect up to 97% of plantar DFU up to 5 weeks before presentation clinically. This system is being used to prevent secondary DFU in a high-risk veteran population with comorbidities including peripheral neuropathy, past amputation, foot deformity, or impaired vascular status.

Methods

Patients were issued a Podometrics mat and trained on proper positioning for daily scans. Patients were instructed to stand with full weight on the mat for 20 seconds while a scan was performed. The resulting thermographic scan was sent to the cloud-based server through cell phone technology. Scans with unilateral thermal asymmetry at any of 6 plantar sites above a threshold or have developed an ulceration, which warranted an alert.

Alerts are sent to clinical staff and the patient is more aggressively monitored for the following weeks. Patients are considered to have “resolved” when the ulcer is healed and then 11.0 two months after enrollment. At a subsequent clinic visit the wound size had not changed. Patient was seen one month later with a wound measuring 1.2 x 0.8 x 0.2cm. It was dressed and an alert was sent on day 2 of use.

Patients with greater than 2 consecutive scans above 1.75°C are considered “in episode.” Alerts are sent to clinical staff and the patient is more aggressively monitored for the following two weeks. Patients are considered to have “resolved” when they either have consistent scans below the threshold or have developed an ulceration, which contraindicates subsequent daily use of the mat requiring a “pause” on the mat until healed.

Case 1

69-year-old male with DM2 (A1c >12.3) on two months prior to enrolling, then 11.0 two months after enrollment, neuropathy, HTN, HLD, PVD, lymphedema. Right TMA performed in conjunction with angio/footing in 2009.

Patient enrolled with very large asymmetry at right foot top mat, and an alert was sent on day 2 of use. When the patient presented to clinic two weeks later with a wound measuring 1.2 x 0.8 x 0.2cm. It was dressed with a moistened collagen product and he was placed in an offloading insert in a CAM boot. A consult was placed to prosthetics for offloading insert for his diabetic shoes which the patient picked up the same day. Between weeks 6 and 7, the patient showed temperature differential of >3°C, alternating right to left. Upon exam during a clinic visit at the end of week 7, the patient’s wound was found to be healed.

Despite this, thermography showed the patient remained in episode through week 11, with temperature differential still exceeding 6°C. The patient presented to clinic at the end of week 11 wearing sandals with no offloading, with pre-ulcerative callus to the area of concern. Upon debridement, the plantar medial hallux IPJ showed appearance of deep tissue injury. The patient was reminded of the importance of offloading, and metatarsal bars were added to the patient’s sandals. The patient was casted for custom orthotics with sweet spot at the hallux IPJ.

The patient’s asymmetry episode resolved shortly thereafter, and he has remained hotspot free and ulcer free for the last six weeks.

Case 2

80-year-old male with DM2 (A1c 7.7), neuropathy, HTN, HLD. Patient enters hotspot episode three weeks after enrollment with temperature differential exceeding 5°C for two consecutive days. The patient had a peak temperature asymmetry of 85°C. A voicemail was left to decrease walking and change shoes. One week later, the patient remained in episode with asymmetry of nearly 4.7°C on the right foot.

Patient presented to clinic at week 5 wearing Crocs, with a pinpoint ulceration to the plantar medial hallux IPJ post-debridement. A consult was placed to prosthetics for offloading insert for his diabetic shoes which the patient picked up the same day. Between weeks 6 and 7, the patient showed temperature differential of >3°C, alternating right to left. Upon exam during a clinic visit at the end of week 7, the patient’s wound was found to be healed.

Conclusion

Three patients with previous ulcerations were alerted via the Podometrics system to be at high risk for imminent re-ulceration due to temperature differentials greater than facility protocol of 1.75°C. These patients were brought to clinic for evaluation early enough to decrease the need for costly advanced modalities, morbidity, and mortality.

References