

## Morphological Pattern Classification System for Plantar Thermography of Patients with Diabetes

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### Abstract

#### Background:

A plantar temperature distribution can be obtained by thermography; however, the advantage has not been effectively utilized in the past. We previously proposed a classification method based on the angiosome concept, but the method was insufficient because it was too subjective and complicated for clinicians. In this study, we propose a new classification system of plantar forepart thermographic patterns using an image segmentation technique.

#### Methods:

A cross-sectional observational study was conducted including 32 healthy volunteers and 129 patients with diabetes mellitus (DM). Individual thermographic variations and trends were evaluated. A comparison was conducted between the patterns obtained by our previous angiosome-based research and the patterns found by the new classification system.

#### Results:

The system objectively found wider variations of the plantar forepart thermographic patterns in the patients with DM compared with those in the control subjects. In patients with DM, the system showed that the whole-high pattern was most frequent (46%), followed by the butterfly pattern (12%). In the control group, the butterfly pattern was most frequent (44%), followed by the whole-high pattern (19%). Both ankle and toe brachial indices were higher in feet with high temperature area in the inner side of the plantar.

#### Conclusions:

Thermographic patterns found by the new computer-based system were similar to those obtained in our previous subjective work. The classification system found forefoot-low pattern and tiptoe-low pattern objectively. The system based on infrared thermography will be a screening tool to assess circulatory status in daily foot care of patients with DM.

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**Abbreviations:** (ABI) ankle brachial index, (DM) diabetes mellitus, (IR) infrared, (TBI) toe brachial index

**Keywords:** angiosome, diabetic foot, image processing, plantar skin temperature, thermography

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