ABSTRACT

Title: Role of multipoint contact photoplethysmography in assessing changes in blood flow in the plantar aspect of the contralateral foot following amputation in patients with type 2 diabetes mellitus

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BACKGROUND

Accurate and reliable assessment of blood flow over the foot in diabetics is imperative in identifying areas of the foot at risk for ulceration. Hence there is a need to explore methods that are direct indicators of microvascular changes and local blood flow over the foot.

OBJECTIVES

1. The primary objective of this study was to determine peak amplitudes and peak times using photoplethysmography waveforms as a measure of change in blood flow in the plantar aspect of the contralateral foot in diabetic patients following amputation.
2. The secondary objectives included -
    - Comparison of changes in blood flow over the plantar aspect of the foot in diabetic patients with age and gender matched normal subjects

- Mapping of variations in blood flow over the plantar aspect of the foot and identify areas of early microvascular changes in the foot.

METHODS

The study included patients with diabetes mellitus who had undergone any form of amputation of one limb as the cases and normal healthy individuals without diabetes as controls. Reflectance type photoplethysmograph sensors were used over six regions of the foot namely hallux, medial forefoot, middle forefoot, lateral forefoot, lateral midfoot and heel to assess the photoplethysmograph waveform pattern in three different positions i.e., supine, sitting and standing. Data was acquired through an indigenous data acquisition system and routed to a laptop for recording and further analysis. Toe pressures were also measured for both groups to serve as a baseline indicator of blood flow to the lower limb.

RESULTS AND CONCLUSION

The peak amplitudes were higher in diabetics when compared to non-diabetics. All three regions of the forefoot showed statistically significant increase in the peak amplitude when compared to controls. The hallux was found to have the maximum peak amplitude in both groups indicating maximum local blood flow. There was also a significant change in the peak amplitude on assuming a sitting position from supine position. Even when toe pressures were unable to detect changes in blood flow between the two groups, photoplethysmograph waveforms showed significant difference between the two groups. Therefore, the results of this study laid the foundations for exploring the use of

photoplethysmography in the clinical setting for detecting early, subclinical changes in the foot of diabetics.

Keywords – Photoplethysmograph, diabetes mellitus