Continuous Homecare Monitoring of Diabetic Foot Syndrome Using Plantar Pressure-Sensitive Systems

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Abstract—Patients with diabetes are at a high risk of developing diabetic foot syndrome, leading to costly foot ulcerations caused mainly by high peak plantar pressures. Continuous homecare monitoring of the diabetic foot, using plantar pressure-sensitive systems integrated to a computer-assisted model for diagnoses and orthotic management, are required by physicians to improve early clinical diagnosis and therapy. Pressure measurement devices, such as in-shoe electronic insoles and platforms are expensive for patients, and are only used in research labs. This paper evaluates a follow-up study on plantar pressure distribution, in a group of subjects with and without diabetes, using the Loran EPS/R1 Platform, and the viability of its incorporation in a computer model.

I. INTRODUCTION

Patients with Type 2 diabetes, suffering from peripheral neuropathy, are at high risk of developing diabetic foot syndrome, leading to foot ulcerations caused mainly by high peak plantar pressures. Decreased sensation, in combination with high underfoot pressure, has been identified as a prime etiology factor in the cause of plantar neuropathic ulceration. Continuous homecare monitoring of diabetic foot syndrome using plantar pressure distributions (PPDs) is essential for early diagnoses of risk ulceration [1].

Pressure-sensitive systems which record and analyze subjects’ PPDs, are not integrated within a personal health system, for diabetic foot management at the clinical practice. Each diabetic patient requires an individual assessment, and often a personalized insole based on their continuous monitoring PPD.

Existing commercial systems, such as pressure platforms and instrumentation insoles are expensive, and used exclusively in labs which are not integrated to a personal health system. Ostadabbas et al. [2] developed a novel Sparse Sensing Continuous Plantar Pressure Model (SCPM) that reconstructs a continuous image of foot plantar pressure with a reduced number of sensors, also making the system more affordable to the patient. However this system is not integrated into a computer model to evaluate and correlate the data with other risk factors associated with the syndrome.

II. DISCUSSION

Our BASPI Research Group is developing a computer-assisted model (see Fig. 1) for diagnosis and orthotic management of the diabetic foot, based on continuous homecare monitoring of PPD required by physicians to improve early clinical diagnosis and ulcer treatment.

The Loran Platform, one of the technologies used for pressure measurements, was used to evaluate repeatability during barefoot standing in diabetic and non-diabetic subjects, for future diabetic foot clinical evaluation integrated in the designed computer model. Fourteen subjects were evaluated (8 females, 6 males, 8 non-diabetics and 6 diabetics, age range 30-70 years) and had no musculoskeletal symptoms. Ten measurements were taken using two different techniques for feet and posture positioning, during three sessions, once a week. MANOVA analysis results established that the platform measurements are reproducible. [3].

This paper evaluates a follow-up study on PPD, in a previous group of subjects with and without diabetes, using the Loran EPS/R1 platform, and the viability of incorporating it in a computer model for continuous monitoring. Future work includes the development of a methodology for a follow-up study involving more subjects, with possible implementation in a continuous monitoring model.

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REFERENCES


Fig. 1: BASPI research group Continuous Monitoring Model.