Journal of Diabetes Science and Technology
Volume 4, Issue 4, July 2010

SYMPOSIUM

Diabetic Foot Biomechanics and Gait Dysfunction

James S. Wrobel, D.P.M., M.S., and Bijan Najafi, Ph.D., M.S.

Abstract

Background:

Diabetic foot complications represent significant morbidity and precede most of the lower extremity amputations performed. Peripheral neuropathy is a frequent complication of diabetes shown to affect gait. Glycosylation of soft tissues can also affect gait. The purpose of this review article is to highlight the changes in gait for persons with diabetes and highlight the effects of glycosylation on soft tissues at the foot–ground interface.

Methods:

PubMed, the Cochrane Library, and EBSCOhost® on-line databases were searched for articles pertaining to diabetes and gait. Bibliographies from relevant manuscripts were also searched.

Findings:

Patients with diabetes frequently exhibit a conservative gait strategy where there is slower walking speed, wider base of gait, and prolonged double support time. Glycosylation affects are observed in the lower extremities. Initially, skin thickness decreases and skin hardness increases; tendons thicken; muscles atrophy and exhibit activation delays; bones become less dense; joints have limited mobility; and fat pads are less thick, demonstrate fibrotic atrophy, migrate distally, and may be stiffer.

Interpretation:

In conclusion, there do appear to be gait changes in patients with diabetes. These changes, coupled with local soft tissue changes from advanced glycosylated end products, also alter a patient's gait, putting them at risk of foot ulceration. Better elucidation of these changes throughout the entire spectrum of diabetes disease can help design better treatments and potentially reduce the unnecessarily high prevalence of foot ulcers and amputation.

J Diabetes Sci Technol 2010;4(4):833-845

Author Affiliation: Center for Lower Extremity Ambulatory Research at Scholl College of Podiatric Medicine, Rosalind Franklin University of Medicine and Science, North Chicago, Illinois

Abbreviations: (AF) skin autofluorescence, (AGEs) advanced glycosylation end products, (AUC) area under the curve, (BMD) bone mineral density, (BMI) body mass index, (DFU) diabetes-related foot ulcer, (DM) diabetes mellitus, (DMPN) diabetes mellitus and peripheral neuropathy, (EMG) electromyography, (FHL) flexor hallucis longus, (GRFs) ground reactive forces, (HbA1c) glycated hemoglobin, (LJM) limited joint mobility, (MPJ) metatarsal phalangeal joint, (MRI) magnetic resonance imaging, (MT) magnetization transfer, (MTP) metatarsophalangeal, (PPP) peak plantar pressure, (PTI) pressure time integral, (RF) regression factor, (STI) shear-time integral, (STJ) subtalar joint

Keywords: biomechanics, diabetes, foot

Corresponding Author: James Wrobel, D.P.M., M.S., at CLEAR, Rosalind Franklin University of Medicine and Science, 3333 Green Bay Road, North Chicago, IL 60064; email address *James.wrobel@rosalindfranklin.edu*