



THE ROLE OF ALTERED WINDLASS MECHANISM IN PATIENTS WITH DIABETES AND NEUROPATHY WITH PREVIOUS ULCER IN THE FIRST METATARSAL HEAD

García-Álvarez Y⁽¹⁾, Lázaro-Martínez JL⁽¹⁾, García-Morales E⁽¹⁾, Álvaro-Afonso FJ⁽¹⁾, Aragón-Sánchez J⁽²⁾, Chana-Valero P⁽¹⁾
(1) Diabetic Foot Unit. University Podiatry Clinic. Complutense University. Madrid. Spain.
(2) Diabetic Foot Unit. La Paloma Hospital. Las Palmas de Gran Canaria. Spain.

Introduction

The limitation of the first metatarsophalangeal joint (MPJ) in patients with diabetes mellitus (DM) produces mechanical stress by collapsing the foot, making the gait unstable, and increasing the pressure on plantar surface ^(1, 2). That is the reason why it has been considered as risk factor in the first metatarsal head ulceration, as well as other general factors, such as body mass index and the presence of pronated foot and diabetic neuropathy (DN) ^(3, 4).

Aim

To analyze the relationship between the Windlass mechanism (WM) alteration and previous ulcer in the first metatarsal head on plantar surface.

Methods

Observational study in which 788 patients from the Diabetic Foot Unit of the Complutense University of Madrid were enrolled between February 2007 and February 2009. This study included subjects with and without DM who had no active ulcer at enrollment. Demographic variables and the general and specific history of DM were recorded. Patient's foot type according to the Foot Posture Index, joint mobility, WM, deformity and previous ulcer were recorded.

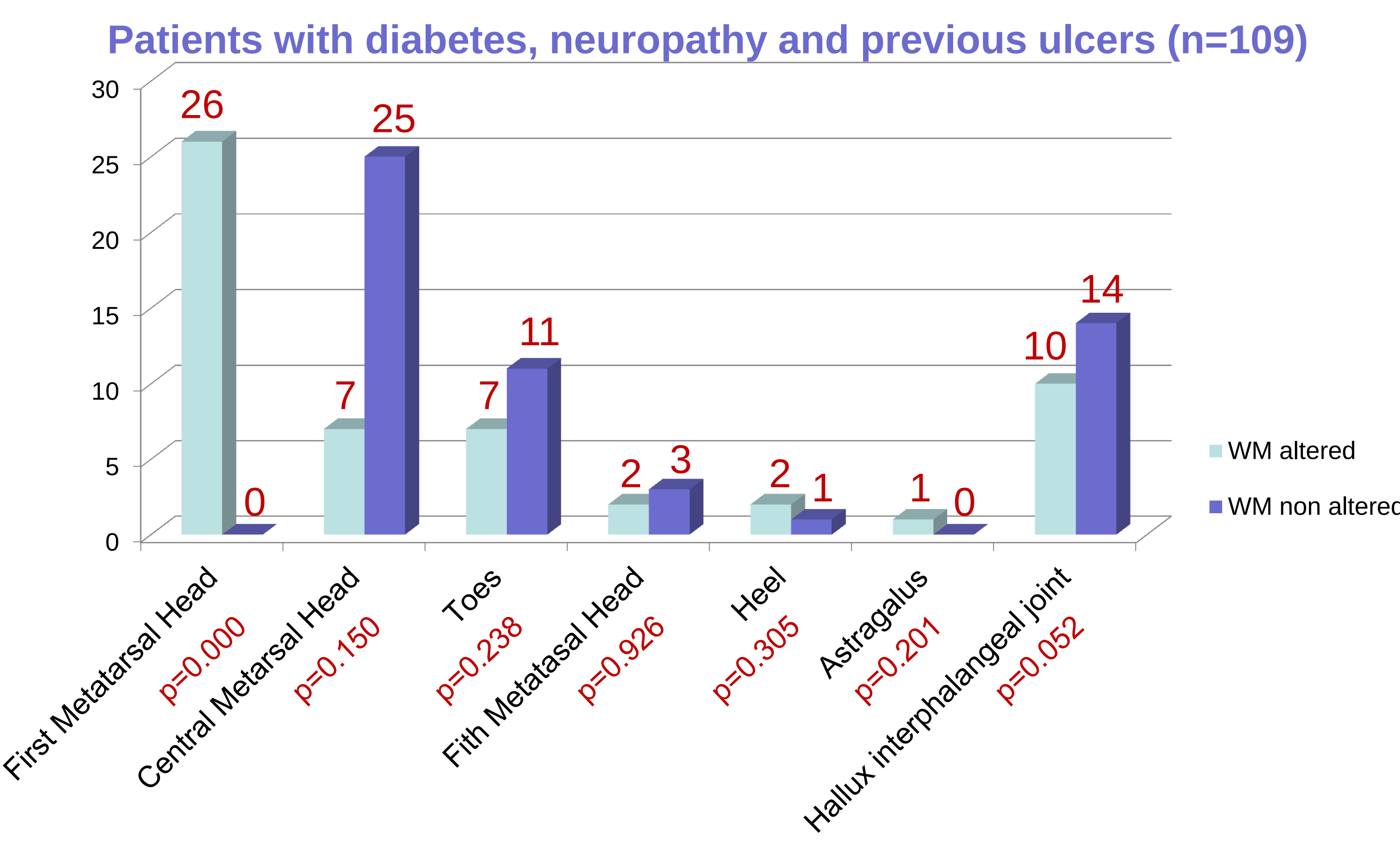


Results

A total of 788 subjects were included in the study. Of these, 41.24% (n=325) were non-diabetics, 29.57% (n=233) were patients with diabetes without neuropathy, and 29.19% (n=230) patients suffered from diabetes and neuropathy. It was observed a higher limitation in foot joint motion ranges in patients with DM. More specifically, in patients with DM and DN, joint limited was more severely affected in inversion of the subtalar joint ($p<0.001$) and the first metatarsophalangeal joint when unloaded ($p<0.05$). Also there was an increase in degrees of valgus in the neutral calcaneal stance position ($p<0.001$). Additionally, in all cases where previous ulcer in the first metatarsal head on plantar surface were found, the WM was altered ($p<0.001$), [OR (95% CI): 5.963 (2.671-13.309)].

Assessment of joint mobility ranges in the three study groups					
Type of mobility examined	Reference value (°)	Patients without diabetes (n=325)	Patients with diabetes (n=463)		P value
			Non-neuropathic Patients (n=233)	Neuropathic Patients (n=230)	
Dorsal ankle joint (knee extended)	90	98.72 ± 20.01	78.40 ± 33.76	90.75 ± 14.55	0.799
Dorsal ankle joint (knee flexed)		112.26 ± 20.37	80.69 ± 52.10	109.16 ± 16.68	0.149
STJI	20	22.34 ± 8.25	23.77 ± 6.88	20.35 ± 8.94	<0.001*
STJE	10	11.37 ± 6.48	6.47 ± 5.10	7.33 ± 5.82	<0.001*
First MPJ loaded	25 to 30	34.52 ± 20.15	19.49 ± 13.76	20.80 ± 21.63	<0.001*
First MPJ unloaded	65	55.67 ± 22.01	56.90 ± 19.85	51.18 ± 21.63	0.003*
NCSP	0 Varus	1.68 ± 3.06	0.67 ± 13.53	1.05 ± 2.10	0.178
	-3 Valgus	-1.93 ± 2.39	-1.67 ± 3.21	-2.08 ± 2.60	<0.001*

MPJ, metatarsophalangeal joint; NCSP, neutral calcaneal stance position; STJE, subtalar joint eversion; STJI, subtalar joint inversion; MPJ, metatarsophalangeal joint. * Statistically significant ($p < 0.05$). Patients with neuropathy versus rest of sample.



Discussion

There is a relationship between the alteration in the WM in patients with DM and precedents of ulcer in the first metatarsal head on plantar surface. The inclusion of the WM in the biomechanical protocol of these patients will allow to warn of the high risk of developing ulcers, and establish the appropriate secondary and tertiary prevention tasks, with the main objective of avoiding surgery at this level, which could trigger important biomechanical alterations with difficult treatment.

References

[1]. Lavery LA, Armstrong DG, Vela SA, Quebedeaux TL, Fleischli JG. Practical criteria for screening patients at high risk for diabetic foot ulceration. Archives of Internal Medicine 1998;158(January (2)):157–62. [2]. Abboud RJ, Rowley DI, Newton RW. Lower limb muscle dysfunction may contribute to foot ulceration in diabetic patients. Clinical Biomechanics (Bristol Avon) 2000;15(January (1)):37–45. [3]. Nube VL, Molyneaux L, Yue DK. Biomechanical risk factors associated with neuropathic ulceration of the hallux in people with diabetes mellitus. Journal of the American Podiatric Medical Association 2006;96(3):189–97. [4] Lázaro-Martínez JL, Aragón-Sánchez FJ, Beneit-Montesinos JV, González-Jurado MA, García Morales E, Martínez Hernández D. Foot biomechanics in patients with diabetes mellitus. Doubts regarding the relationship between neuropathy, foot motion, and deformities. Journal of the American Podiatric Medical Association 2011;101(3):208–14.