

## The role of ankle plantar flexion in the monitoring of diabetic patients at risk of foot ulcer

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Limited ankle joint mobility (AJM) is a major risk factor for ulcers and a useful parameter for monitoring the health of patients with diabetes. The aim of this study was to test the feasibility and usefulness of evaluating AJM for monitoring ulcerative risk. AJM in plantar (PF) and dorsiflexion (DF) was evaluated in 99 patients with diabetes, type1/type2: 50/49, (58/41;M/F), and 59 healthy controls (32:27/M:F). Patients and controls were divided into 6 groups by age and neuropathy: 32 young patients (group YD), mean age 12.4±2.0 yr, 29 young controls (group YC), mean age 11.4 ± 3.3 yr, 38 elderly patients without neuropathy (group ED), mean age 58.5 ±10.3 yr, 15 neuropathic patients without history of foot ulcer (group ND), mean age 62.1 ± 7.9 yr, 14 neuropathic patients with history of foot ulcer (group NUD), mean age 64 ± 8.4 yrs, and 30 elderly healthy controls (group EC), mean age 60.3 ± 6.4 yr. AJM was evaluated by an inclinometer with the patient lying supine, the subtalar joint in neutral position and with the ankle in the position freely taken at the beginning. The knee, corresponding to the evaluated ankle, was extended and put over a rigid 5-cm high support. Diabetes duration was respectively: group YD 5.5 ± 3.5 yr, ED 16.5 ± 10.6 yr; ND 18.2 ± 13.1 yr and NUD 13.7 ± 9.6 yr. The NUD group showed a more significant AJM reduction in DF and PF than all other groups ( $p < 0.005$ ). The reduction was 40.1% compared to the EC group and 46.9% compared to the YC group (78.1 ± 18.4 vs 147.2 ± 19.1, 130.4 ± 15.1). Only the DF was significantly reduced in the NUD group compared to the ED group ( $p < 0.001$ ). The YD had more reduced AJM in both movements compared to the young controls (YC) ( $p < 0.001$ ) with PF more reduced than DF (30.9% vs 15.5%). Among patients and controls the elderly groups had significant reduction of only DF (EC vs YC  $p < 0.001$ ; ED vs YD  $p < 0.05$ ). As in previous studies, these results confirm that an AJM reduction of about 40% (28-32) in patients with diabetic neuropathy can be considered as a threshold for ulcer risk. The method used permits direct evaluation of AJM in plantar flexion that seems to show an early reduction in diabetic subjects, thereby providing useful information for patient monitoring.

### References

- [1] Francia et al. (2014) Diabetic foot and exercise therapy: step by step. The role of rigid posture and biomechanics treatment. *Curr Diabetes Rev* 10: 86-99.
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### Keywords

Diabetic foot, diabetes, limited joint mobility.