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Skin hydration and tangential stress in neuropathic diabetic patients

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Introduction. Diabetes is responsible for the non-enzymatic glycosylation of collagen and keratin of the skin corneum stratum. Glicosylated proteins induce physical and functional changes which might render the skin frail. In addition the loss of sweating related to autonomic neuropathy may contribute to render the skin more frail and therefore unable to manage the increased tangential forces developed under the metatarsal area during the propulsion phase of gait in neuropatic patients. **Purpose.**The study evaluates the hydration of the corneum stratum of the foot skin, and the function of the dermo-epidermal barrier in presence of diabetes with or without peripheral neuropathy. The study also investigates plantar pressures and forces during gait and eventual relationships with skin alterations. Materials and Methods.18 diabetic patients with neuropathy (DN), 19 diabetic patients without neuropathy (D) and 10 healthy control subjects (C) have been recruited. Assessment of neuropathy level has been performed through the Neuropathy Disability Score (NDS). All patients have been submitted to the evaluation of corneum stratum hydration(CM)(g\h+m^2) with the Customer MPA580 (CK electronic GmbH) and the Trans Epidermal Water Loss (TEWL)(g\h+m^2) with TM300 to evaluate the loss of trans-epidermal water (TM). Three plantar areas – namely heel, medial midfoot and lateral midfoot - have been considered and the average value has been calculated for each parameter. DN patients have also been examined as for the main biomechanic parameter of gait. More specifically, plantar pressure (P) and the three components of the ground reaction force – FZ: vertical force; FX: anterior-posterior force; FY: medio-lateral force – have been obtained by using an integrated piezo-dynamometric platform previously validated at the Italian National Institute of Health (ISS, Rome, Italy). **Results:** A CM reduction has been highlighted in all diabetic patients (DN 16.6±2, D19.6±1.6, C 28.8±1) (DN and D vs C: p=<0.05). For the TEWL the following mean values have been obtained: DN=29.4±1..7, D=34.8 ±0.9, C=34.4 ± 1) (DN vs C and D: p=<0.5). Peak plantar pressure has been found significantly increased in DN: 770±270kPa versus C: 520±180kPa (p=0.001). A significant increase in medio-lateral tangential force has been observed in DN:6.4±2.2%N versus C: 5.0±2.0%N (p=0.047). No correlations have been found between plantar pressure and CM, while an inverted linear regression has been observed between the TEWL in the metatarsal area and the medio-lateral component of the force (R2=-0.7). **Discussion.** The study has demonstrated that the skin of diabetic patients is more dry than normal. In presence of neuropathy the changes in TEWL highlight a further impairment of the skin. The relationship between the increased medio-lateral forces and trans-epidermal water loss suggests that in DN patients more concurrent factors may contribute to the increased risk of ulceration.