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3D foot scanning – a novel approach for detection of diabetic foot deformities

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Background and aims. Foot deformity is a well-known risk factor for ulceration. New 3D footscan technology is a useful, low price tool for measurement of foot size and shape. The foot scanner is used in the retail shops and in the clinics dealing with foot disorders in order to detect foot deformities and to facilitate the selection of appropriate shoes from serial production in spite of hallux valgus, flat feet, claw- or hammer toes. We sought to investigate whether the results of 3D foot scanning are comparable to the results of clinical foot examination. Patients and methods. 3D foot scanning was performed together with routine foot screening in 154 out-patients with diabetes mellitus. Claw-toe index (CTI, ratio between toe height and height of MTP joint) was calculated for each toe (from 2nd to 4th) separately. The toe height was further defined as a maximum height on the distance from the toe tip to 10% of the foot length. The MTPJ height was defined as a maximum height on the distance from 10% to 20% of the foot length. Hallux valgus index (HVI) was defined as an angle (in degrees) on the horizontal plane between the foot axis and the line fitted on the outer contour of the big toe. Results: Foot screening revealed 52 patients (33.8%) with claw toes and 34 (22.1%) with hallucis valgi. CTI and HVI values differed significantly between the subgroups with and without clinically recognized deformity (all $p<0.000$). The cut-off values (weighted average of the two group means) for clawing of the 2nd, 3rd and 4th toe on the left (L) and right (R) foot were 0.75, 0.76, 0.76, 0.77, 0.78 and 0.80, respectively. The sensitivity, specificity, positive and negative predictive value of the 3D foot scanning results for claw toes were 40.4 %, 88.7 %, 72.4 % and 75.2 %, respectively. The cut-off values for hallux valgus were 8.47 degrees (L) and 5.98 degrees (R). The sensitivity, specificity, positive and negative predictive value of the 3D foot scanning results for hallux valgus were 35.3 %, 97.5 %, 80.0 % and 84.2 %.
Conclusions. 3D foot scanning is a quick, cheap, simple and reliable method for detection of common foot deformities which can be used routinely to facilitate the choice of proper footwear in the patients with diabetes mellitus.