

## **Distribution of plantar shear stresses in diabetic neuropathic patients**

**Purpose:** Diabetic foot ulcers are known to have a biomechanical etiology. Among the mechanical factors that cause foot lesions, shear stresses have been either neglected or underestimated. The purpose of this study was to compare plantar pressure and shear variables in diabetic and control groups.

**Methods:** Fifteen diabetic patients with neuropathy and twenty non-diabetic subjects without foot symptoms were recruited. Subjects walked on a custom-built platform capable of measuring local normal and tangential forces simultaneously.

**Results:** Pressure-time integral quantities were increased by 54% ( $p=0.013$ ) in the diabetic group. Peak AP and resultant shear magnitudes were found to be 32% larger ( $p<0.05$ ) even though diabetic subjects walked at a slower velocity. Lower AP and ML stress range (peak-to-peak) values were observed in the control subjects ( $p<0.05$ ). Shear-time integral values were increased in the diabetic group by 61% and 132% for AP and resultant shear cases, respectively ( $p<0.05$ ). Regional analysis of the results revealed increased shear stress values, particularly under the hallux of diabetic patients. In 59% of the diabetic patients peak pressure and shear locations deviated whereas this ratio was 47% in the control group.

**Conclusions:** Plantar shear distribution has the potential to explain the deviation between peak pressure and ulcer locations and help researchers design more effective interventions. AP and ML shear, which exhibit increased values in diabetic neuropathic patients, fundamentally act with twice the frequency of vertical stress. This phenomenon might trigger a fatigue failure mechanism and cause foot ulcers.

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