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Gait event detection using linear accelerometers or angular velocity transducers in able-bodied and spinal-cord injured individuals

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## Abstract

We report on three different methods of gait event detection (toe-off and heel strike) using miniature linear accelerometers and angular velocity transducers in comparison to using standard pressure-sensitive foot switches. Detection was performed with normal and spinal-cord injured subjects. The detection of end contact (EC), normally toe-off, and initial contact (IC) normally, heel strike was based on either foot linear accelerations or foot sagittal angular velocity or shank sagittal angular velocity. The results showed that all three methods were as accurate as foot switches in estimating times of IC and EC for normal gait patterns. In spinal-cord injured subjects, shank angular velocity was significantly less accurate ( $p < 0.02$ ). We conclude that detection based on foot linear accelerations or foot angular velocity can correctly identify the timing of IC and EC events in both normal and spinal-cord injured subjects.

**Keywords:** Gait analysis; Inertial sensors; Foot contact detection

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<sup>1</sup> CMT is an inherited peripheral neuropathy disease affecting approximately 10–36 individuals in 100,000. It is characterized by progressive muscle weakness accompanied by mild sensory loss.

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