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► **To cite this version:**

F. Degache, M. Zollinger, D. Currat, L. Pochon, Nicolas Peyrot, et al.. Mechanics of overground and treadmill walking in children. *Annals of Physical and Rehabilitation Medicine*, 2014, 57, pp.CO76-003-e. 10.1016/j.rehab.2014.03.607 . hal-01390529

HAL Id: hal-01390529

<https://hal.univ-reunion.fr/hal-01390529v1>

Submitted on 2 Nov 2016

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Mechanics of overground and treadmill walking in children

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Keywords: Biomechanics; Gait; Human locomotion; Inverted pendulum Background and objective.— Motor impairments associated with cerebral palsy (CP) induce abnormal gait in children. The improvement of walking is an essential objective and the use of treadmill for walking analysis and training may offer several advantages. However, a controversy still exists regarding the similarity between treadmill and overground walking. The aim of this study was to compare the mechanics of these two types of gait modalities at standard and preferred walking speeds in hemiplegic cerebral palsy (HCP) and typically developing (TD) children matched on age, height and body mass.

Methods.— Mechanical parameters of walking were computed using two inertial sensors equipped with a triaxial accelerometer and gyroscope and compared in 10 HCP (14.2 ± 1.7 yr) and 10 TD (14.1 ± 1.9 yr) children during treadmill and overground walking at standard and preferred speeds.

Results.— The treadmill compared with the ground, induced almost identical mechanical changes in HCP and TD children with the exception of mechanical potential and kinetic vertical and lateral works, which are both significantly increased in the overground treadmill transition only in HCP children ($P < 0.05$). **Conclusions.**— These results showed that HCP children have a reduced adaptive capacity in absorbing and decelerating the speed created by treadmill.