

**PATHOKINESIOLOGY LABORATORY
RANCHO LOS AMIGOS NATIONAL REHABILITATION CENTER**

ABSTRACTS FROM CONFERENCE PRESENTATIONS (2003 – 2005)

Comparison of vertical shoulder joint reaction forces during free and fast ambulation with crutches and a walker in persons with incomplete spinal cord injury. Lighthall-Haubert L, Newsam CJ, Gutierrez DD, Gronley JK, Mulroy SJ, Perry J. *J Spinal Cord Med* 2004;27(2):159.

Objective: To determine the effect of assistive device on vertical shoulder force during free and fast ambulation in persons with incomplete spinal cord injury (SCI).

Design: Within groups comparison

Participants/Methods: Thirteen subjects with incomplete SCI (4 tetraplegia, 9 paraplegia) participated (mean age = 37 years, time since SCI = 6 years). Subjects walked with instrumented crutches and a walker across a 10-meter walkway. Upper extremity and trunk motion was collected using a VICON motion analysis system. Shoulder forces were calculated using an inverse dynamics approach.

Results: Free walking speed during crutch and walker ambulation was similar (40 and 38m/min, respectively). Fast walking speed increased comparably for the crutch and walker conditions (59 and 56m/min, respectively). During free walking, peak vertical forces were higher during crutch ambulation (50 vs. 47 Newtons [N]; $p=.04$). During fast walking, a trend was identified for higher peak forces with crutches (85 vs. 52N; $p=.09$). Rate of loading was significantly faster during ambulation with crutches than with a walker for both free (215 vs. 185 N/sec.) and fast (523 vs. 217 N/sec.) speeds. There were no differences in force-time-integral between assistive devices for both speeds.

Conclusion: Higher peak force and loading rate during crutch ambulation represents a greater shoulder demand, which should be considered when recommending an assistive device. Although the average difference in peak force with free crutch walking was small, the repetitive nature of this force and the substantially higher loading rate with every stride may challenge individuals with weakness or pain.

Acknowledgement: Funded by the National Institutes of Health Grant #HD37544
