# Robotic-assisted treadmill therapy in clinical practice after central nervous system injury

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## Introduction

Robotic aids for rehabilitation hold considerable promise but have not yet achieved widespread clinical adoption. Barriers to adoption include the limited data on efficacy, the single-purpose design of existing robots, financial considerations, and clinicians' lack of familiarity with this technology. Although the path forward to clinical adoption may be slow and have several false starts, the labor-saving aspect of robotic technology will ultimately ensure its adoption.

## Objectives

Structural changes to the central and peripheral nervous system make an important etiologic factor for gait abnormalities in patients after an injury to the central nervous system (CNS). Activity (rehabilitation) plays a crucial role in CNS reorganization and formation of new functional connections. Independent gait is one of the priorities in rehabilitation in all CNS pathologies. Adverse effects associated with gait abnormalities include falls, reduced aerobic fitness, and limited community access.

Very limited data is available about the influence of robotic-assisted treadmill therapy on walking and standing performance in the adult TBI and MS population. With robotic assisted training we can influence intensity, safety, capability and participation during rehabilitation with a substantial and on-going feedback. The aim of the presented study was to compare the effect of robotic-assisted treadmill therapy on walking performance in adult subjects after moderate and severe TBI and MS subjects.

## Methods

18 adult ambulatory subjects with gait abnormalities after moderate and severe (GCS < 13) TBI in chronic phase (> 1 year after injury, average 6.6, range 1-16

years) and 9 subjects with MS (M F) with average EDSS score of 5.3 (3.5 – 6.5) were included in the study. Each subject in both (TBI and MS) groups received 10 sessions of 30 minutes of robotic-assisted treadmill training on Lokomat (Hocoma-CH) as monotherapy. Three standardised assessments were performed before and after the therapy: 10-Meter Walking Test (10MWT), 6-Minutes Walking Test (6minWT), Get Up and Go Test (GUGT). The data were analysed as the ratio between the value of the second and the first assessment for all tests except 6minWT, where the inverse ratio was calculated (hence, the more a ratio was above 1, the larger the improvement for all four walking tests). Exact Wilcox rank sum test (EWRST) was used to compare absolute and relative improvements among both groups.

## Results

On average, patients in TBI and MS group improved absolutely and relatively in all the performed tests. TBI group showed greater absolute and relative improvement, but differences between groups were not statistically significant.

Relative improvement on 10MWT in TBI group was 11% (SD 19%) and in MS group 4% (SD 18%), with EWRST 0.315. Relative improvement on GUGT in TBI group was 21% (SD 23%) and in MS group 8% (SD 23%), with EWRST 0.215. Relative improvement on 6minWT in TBI group was 26% (SD 28%) and in MS group 6% (SD 52%), with EWRST 0.089. No statistically significant correlation between the length of the post-injury period and improvement in walking performance in TBI was found.

## Conclusions

Robotic-assisted treadmill therapy seems to improve walking tests performance in adult brain injury subjects in the chronic (>1 year post-injury) period better than in MS subjects, but comparison of both groups did not show a statistical difference.

**Keywords: robotic-assisted** treadmill therapy, traumatic brain injury, multiple sclerosis, rehabilitation