The Effects of Robot-Assisted Gait Training and Task-Specific Training on ADL Function and Mobility for a Patient After a Stroke: a Case Report

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Background

- Stroke is the fourth leading cause of death and the leading cause of long term disability in the United States.[1]
- Repetitive task-specific training has been shown to be favorable in stroke rehabilitation.[2]
- Robot-assisted gait training (RAGT) incorporates gait training and repetitive task-specific training.
- RAGT has been shown to increase the likeliness of independent walking ability in patients who have experienced a stroke, especially when utilized in first three months.[3]
- Currently there is limited research regarding the impact of RAGT on ADL function.

Purpose

- To describe the impact of robot-assisted gait training in combination with task-specific training on the functional mobility and ADL function in an individual who experienced a middle cerebral artery (MCA) stroke.

Case Description

- 71-year-old male who experienced a right MCA stroke 6 weeks prior
- Complex medical history including:
  - Multiple heart complications
  - Diabetes mellitus
  - Hypertension
  - Dyslipidemia
  - Atrial fibrillation
- Participated in 5 weeks of therapy on a Stroke Rehabilitation Unit prior to admission

Examination

	Admission	Discharge
Bed Mobility		
Rolling	Maximum assist x1 with use of bed rails	Moderate assist x1 with use of bed rails
Supine to/from Sit	Maximum assist x2	Moderate assist x1
Scooting in Supine	Moderate assist x2	Moderate assist x1
Transfers		
Stand-pivot	Maximum assist x1 with contact guard assist x1 to either side	Minimum assist x1 to right Moderate assist x1 to left
Sit to Stand	Maximum assist x1 with contact guard assist x1	Minimum assist x1
Balance		
Static Sitting	Poor with loss of balance posteriorly; requires moderate assist with one hand prop	Good with supervision
Dynamic Sitting	Poor with loss of balance posteriorly and to left side	Fair with loss of balance to left side
Static Standing	Poor with maximum assist	Fair with contact guard assist and use of parallel bars
Dynamic Standing	Poor with maximum assist	Poor with minimum assist x1

Maximum assistance: patient can perform 25% - 49% of task; Moderate assistance: patient can perform 50% - 74% of task; Minimum assistance: patient can perform 75% or more of task; Contact Guard Assist: patient can perform task but requires hands-on contact; Supervision: patient performs task with supervision and without hands-on contact.

- The goals of the patient and his family included increasing the strength of his left side and increasing his independence in mobility.

Impairments:
- Decreased LLE ROM
- Decreased BLE strength
- Increased tone hip and knee extensors
- Impaired motor function
- Impaired balance

Functional Limitations:
- Decreased independence in mobility
- Decreased independence in ADLs
- Unable to ambulate

Disabilities:
- Unable to work

Interventions

- The patient participated in five 1-hour PT sessions during the week
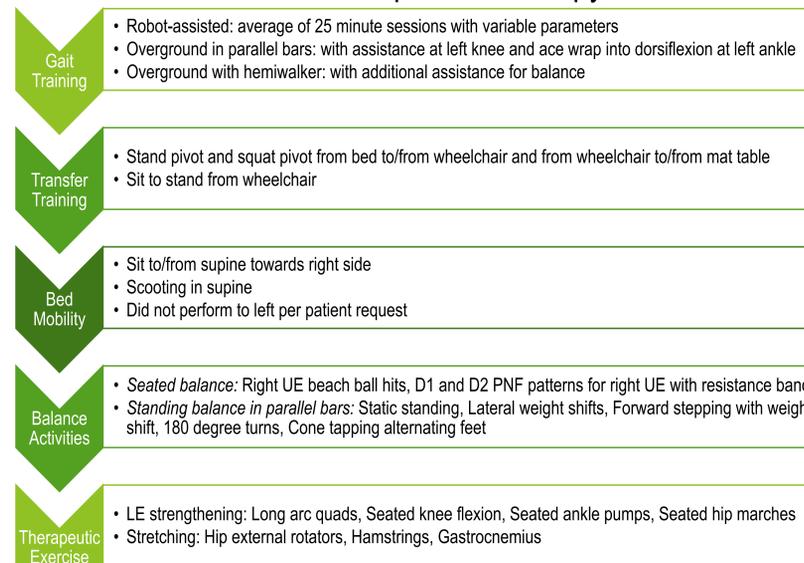- Treatments coordinated with occupational therapy, which focused on upper extremity function

Gait Training
- Robot-assisted: average of 25 minute sessions with variable parameters
- Overground in parallel bars: with assistance at left knee and ace wrap into dorsiflexion at left ankle
- Overground with hemiwalker: with additional assistance for balance

Transfer Training
- Stand pivot and squat pivot from bed to/from wheelchair and from wheelchair to/from mat table
- Sit to stand from wheelchair

Bed Mobility
- Sit to/from supine towards right side
- Scooting in supine
- Did not perform to left per patient request

Balance Activities
- *Seated balance:* Right UE beach ball hits, D1 and D2 PNF patterns for right UE with resistance band
- *Standing balance in parallel bars:* Static standing, Lateral weight shifts, Forward stepping with weight shift, 180 degree turns, Cone tapping alternating feet

Therapeutic Exercise
- LE strengthening: Long arc quads, Seated knee flexion, Seated ankle pumps, Seated hip marches
- Stretching: Hip external rotators, Hamstrings, Gastrocnemius

Figure 1: Depicts patient on a robot-assisted gait training device. Picture: Hocoma, Switzerland. http://www.hocoma.com/en/

- Patient/family education included: positioning, bed mobility, transfers, and equipment management.

Outcomes

- After 14 treatment sessions, the patient displayed improvements in ADL performance, functional mobility, balance, and strength.
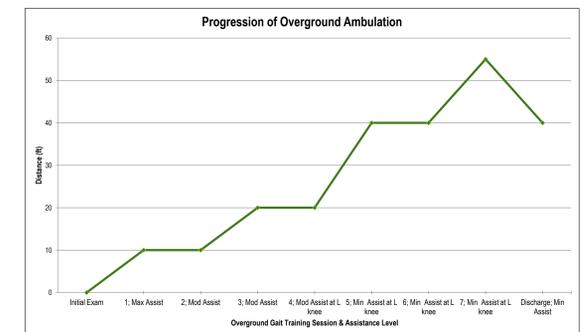

Figure 2: Depicts the patient's progression of overground gait training, including both distance and assistance level required.
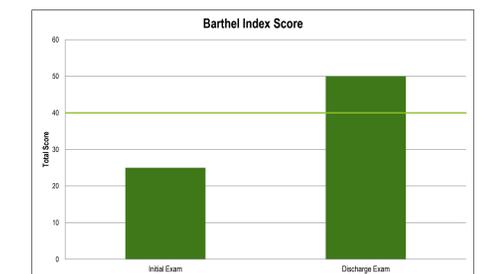

Figure 3: Initial and discharge scores of the Barthel Index. Maximum possible score is 100. A score of <40 suggests complete dependence in ADLs.

Discussion

- The improvements in mobility and ADL function suggest that the combination of RAGT and task-specific training was a beneficial treatment option for this patient.
- Due to early discharge, it was uncertain how much more improvement in ADL function and mobility may have been gained with the intended amount of therapy.
- Future research should further investigate the impact of RAGT on ADL function.

References
1. Go AS, Mozaffarian D, Roger VL, et al. Heart disease and stroke statistics--2014 update: a report from the American Heart Association. Circulation. 2014;129(3):e28-e292.
2. Foley N, Pereira S, Teasell R, et al. Mobility and the Lower Extremity. Evidence-Based Review of Stroke Rehabilitation. http://www.ebrsr.com/evidence-review/9-mobility-and-lower-extremity. Updated December 2013. Accessed September 2014.
3. Mehrholz J, Elsner B, Werner C, Kugler J, Pohl M. Electromechanical-assisted training for walking after stroke. Cochrane Database of Systematic Reviews 2013, Issue 7. Art. No.: CD006185. DOI: 10.1002/14651858.CD006185.pub3.