

Use of the Ekso™ GT for Treatment in Inpatient Rehabilitation with the Brain Injury Population

Nehal Patel, PT, DPT, NCS, CBIS
Amie Jordan, OTR/L, CBIS



Presentation Goals

- To open a discussion on the use of the Ekso™ GT for patients with BI
- To provide therapists with guidelines for appropriate patients for to the Ekso™
- To review indications and contraindications for use of EKSO
- To discuss patient outcomes with the use of Ekso™ during inpatient rehab stay
- To review potential pros and cons of using the device as a treatment intervention

The Ekso GT™

• What is it?

• Ekso GT™ Is a wearable exoskeleton that enables functional based, intensive, overground gait training and is designed to support the re-learning of correct step patterns and weight shifts, potentially mitigating compensatory behaviors.

• What are some key features?

• Variable Assist™, the adaptive or "smart" software, dynamically provides 0-100% power to either side of the body and promotes a greater number of high-quality steps in a shorter time period for a broad spectrum of patients. Variable Assist allows clinicians to dynamically augment their patients' strength and to strategically target deficient aspects of their gait while the patient walks. It engages patients by challenging their abilities, balancing the physical effort they exert with the amount of help they need to achieve a more normalized gait.



FDA Approval

- April of 2016: Ekso Bionics Holdings, Inc. received clearance from the U.S. Food and Drug Administration (FDA) to market its EKSO GT robotic exoskeleton for use in the treatment of individuals with hemiplegia due to stroke, individuals with spinal cord injuries at levels T4 to L5, and individuals with spinal cord injuries at levels of T3 to C7 (ASIA D), in accordance with device's labeling. (This is based on the high volume of research.
- It may be safe to use with other diagnoses but the research volume is currently not at a place to expand the indications
- "Suitable" patients:
 - SCI, CVA, ABI, MS, GBS, and generalized weakness



Indications - BI

- Hemiplegia with: 1 UE function of at least 4/5
- Involved in standing program
- Under 220lbs
- Clear method of communication
- Height 5'0" - 6'4"
 - Within measurements and adjustments
- Hip width of 18" or less
- ROM: WNL at hip, knee and ankles
 - Neutral DF with knee flexion up to 12°
 - No more than 12° knee flexion contracture
 - No more than 17° hip flexion contracture

Contraindications:

- | | |
|--|---|
| • Severe concurrent medical diseases | • Cognitive impairments resulting in inability to follow directions |
| • Severe spasticity (MAS 4) | • Pregnant women |
| • Unstable spine or unhealed limb or pelvic fractures | • Colostomy |
| • HO | • Poor skin integrity |
| • Significant contractures | • ROM restrictions |
| • Psychiatric or cognitive situations that may interfere with proper operation of the device | • Unresolved DVT |
| | • Lower limb prosthesis |

Warnings

- Osteoporosis – increased fracture risk
- Mild to moderate muscle spasms
- Orthostatic Hypotension – limiting OOB
- Hip dysplasia or hip axis abnormalities
- Impulsivity
- Marsupialization

First Step

- Clinician Control of Step
- Setting Anterior and Lateral WS triggers
- Adjustments in gait:
 - Step length
 - Step height ...
- Letting the patient get a feeling of it

Pro Step

- Patient needs to achieve anterior and lateral WS to target and then Ekso will initiate the step

Pro Step +

- Patient needs to achieve the lateral WS and initiate step with hip flexion/heel off and EKSO will complete the step

- Max vs Adaptive vs Fixed
 - Max -100% Assistance
 - Adaptive – chases the success
 - Swing complete
 - Fast, medium, slow
 - Fixed – therapist sets motor assistance
- L/R Affected
 - Swing and stance support
 - Opp leg free (stance support if needed)
- B Free legs

More rhythmic walking allowing the patient to “chase” the step pattern that EKSO has to teach/learn a better gait pattern

Features other than gait:

Weight Shifting

- Improves patient familiarity with the concept of weight-shifting within the device to achieve and maintain lateral targets, as well as midline orientation, as set by the therapist
 - Biofeedback of visual and auditory cues for Left, Right, and Center



Weight shifting with Free Leg

- Free Leg is an option that allows for no motor assistance during the swing phase of gait.
 - Stance support options include Low, Medium and High
 - Swing Assist: high and low
 - Swing Resistance: High and Low
- Audio feedback set for weight-shifting targets can be used in conjunction with free leg for other interventions (E.g. Marching while maintaining consistent weight shift and stabilizing in SLS)



Squats

- Up to 45°, 65°, 90°
- With high, medium or low stance support

Sidestepping

- Allows for movement in the frontal plane with abduction unlocked
- For added difficulty, rotation can also be unlocked
- Can utilize high, medium or low stance support
- Stepping over obstacles, etc.

Backward Walking

- In free leg mode you can also perform backward walking



Interventional Use

- 90 minute sessions
- 1st session
 - measurement and fitting
 - Sit to stand
 - Introduction to weight shifting + WS with reaching, pre-gait, use of device
 - Initiation of walking in First Step with AD
- Future sessions
 - Progression to ProStep or ProStep+
 - Use of variable assist
 - Side stepping, obstacles, backwards gait

Summary of Data

- 15 patients

	LOS	# Session	FIM Change	Exso Steps
MIN	14	1	10	117
MAX	72	6	60	643
AVG	33.8	3.31	34.4	372

- Regional FIM change average = 28.2
- Our BI FIM change average = 24.95
- D/C location:
 - 9 Home
 - 6 SAR

Initial Observations – Pros

- Ease of transitioning from pregait to gait training
- Ease of live parameter changes as pt progresses
- Increased dose of mass practice of ambulation
- Over ground changes observed
 - Improved weight shifts
 - Improved foot clearance of swing phase
 - Ability to attain heel strike
 - Consistency of obtaining equal, symmetrical step lengths
 - Progression of AD
 - Improved gait speed
 - Improved kinematics
- Increased confidence
- Decreased reliance on body weight support assistance
- Patient-reported satisfaction with device
- Psychosocial changes

Crossover Benefits as seen in Occupational Therapy

- Improved standing balance and tolerance during ADLs
 - Grooming standing at the sink
 - Lower Body Dressing
 - Toileting
 - Showering
- Improved functional transfers to toilet and shower/tub
- Improved functional ambulation during IADLs (kitchen mobility, clothing retrieval, homemaking skills, community re-entry...)
- Decreased fear of falling and increased confidence with ADLs and IADLs

17

Initial Observations - Cons

- Difficult to fully assess gait from behind Ekso GT™
- Reliance on another individual to assist for safety etc.
- Set up and take down time
- Two level certification required in order for therapist to operate the device and conduct training sessions
- Seated rest breaks for the patient can be challenging logistically
- Decreased lengths of stay yield a decrease in the number of Ekso GT™ sessions
- Learning curve for understanding the device for patients
- Limiting session to focus on gait training only

Limitations & Challenges

- Ankle and other contractures
- Severe communication barriers
- Feeding tubes, bone flaps
- WB precautions
- Cognitive deficits
- Agitation and other behavioral changes
- Severe tone and spasms

Plans going forward

- Increase patients use
- Increase dosage during inpatient rehab stay
- Standardized measure pre and post session
- Increase research with BI population with hopes of receiving FDA approval

20

<https://newyork.cbslocal.com/2019/04/10/hi-tech-exoskeleton-stroke-walk/amp/>

21




