



Exoskeletons

Perspectives in Assistive Technology, Stanford 2023

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Who am I?



BS

Mechanical Engineering



MS, PhD

Mechanical Engineering



Principal Controls Engineer

What is an Exoskeleton?



Structure which supports the body from the outside and protects soft tissue.



Who is Ekso Bionics?

- Ekso Bionics[®] develops technology to enhance human mobility, strength, and endurance.



Celebrating 10 Years of Ekso!

Swipe 



Why are we celebrating?

2012

Exactly 10 years ago on February 14, 2012 we shipped our first neurorehab device, Ekso 1.1, to Craig Hospital.

2016

4 years later, our EksoGT was FDA cleared for SCI and stroke.

2019

In August 2019, we launched EksoNR.

2020

In June 2020, EksoNR received FDA clearance for Acquired Brain Injury



372 TOTAL
CENTERS GLOBALLY

220 IN NORTH AMERICA

138 IN EUROPE, MIDDLE EAST & AFRICA

14 IN ASIA PACIFIC



Ekso Acquired Indego



Medical Applications




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"We're finding that patients are progressing far beyond what we've ever been able to get them to because we have this means to get people up earlier."

Dr. Christina Kwasnica, MD
Medical Director,
Barrow Neurological Institute



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Industrial Applications



Some Exos in the Market

- EksoNR, Ekso Bionics
- ReWalk 6.0, ReWalk Robotics
- Indego, Ekso Bionics
- Rex, Rex Bionics

FDA approved



Diagnoses



- Spinal Cord Injury
- Stroke
- Acquired brain injury

- Multiple Sclerosis
- Parkinsons
- Etc.

Benefits



Gait Training

- Repetitive stepping
- Varied assistance
- Balance training

Long-Term Use?

- Bone Density?
- Bowel & Bladder Function?
- Pain?
- Circulation?
- Emotions?

Designing an Exoskeleton

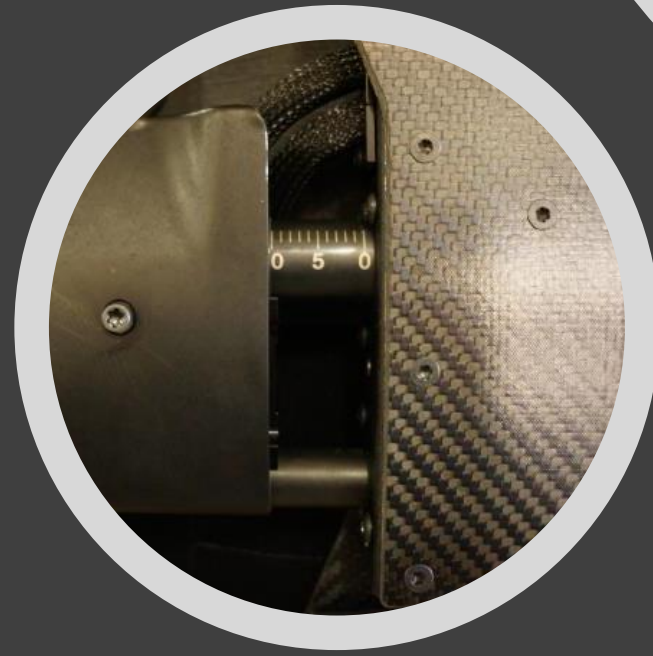
Brainstorm



- What would you consider when designing an exoskeleton for gait rehabilitation to be used in a rehab center?
- What features are important?
- How do you figure out if your design works?

Size Adjustment

- Exoskeletons must adjust to fit their user
- Fit is critical for maintaining comfort and safety
- Fast and accurate adjustments needed in clinical setting



Padding & Fit Kit

- Elimination of pressure points
- Ensure that the user stays aligned with the device



Donning & Doffing



User must be able to get in/out of the device safely and easily

Safety- Fail Safe

- Hard stops & soft stops
- Adjustable settings for SW Joint limits
- Normally-on brakes

Software: Work with the Human

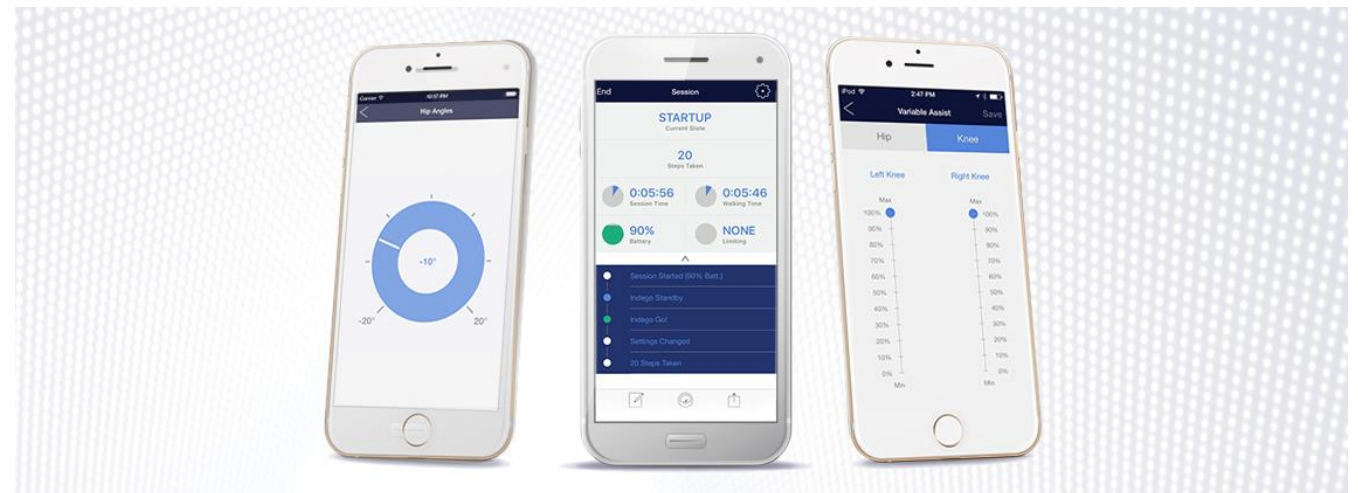


| | |
|-----------------|---|
| Assist | Provide assistance or resistance as needed but only as much as needed |
| Engage | Give the user live guidance and keep engaged |
| Feedback | Provide feedback to improve performance |
| Alert | Alert and react to safety concerns |

Software: Work FOR the Human



- How the therapist interacts with the device is critically important



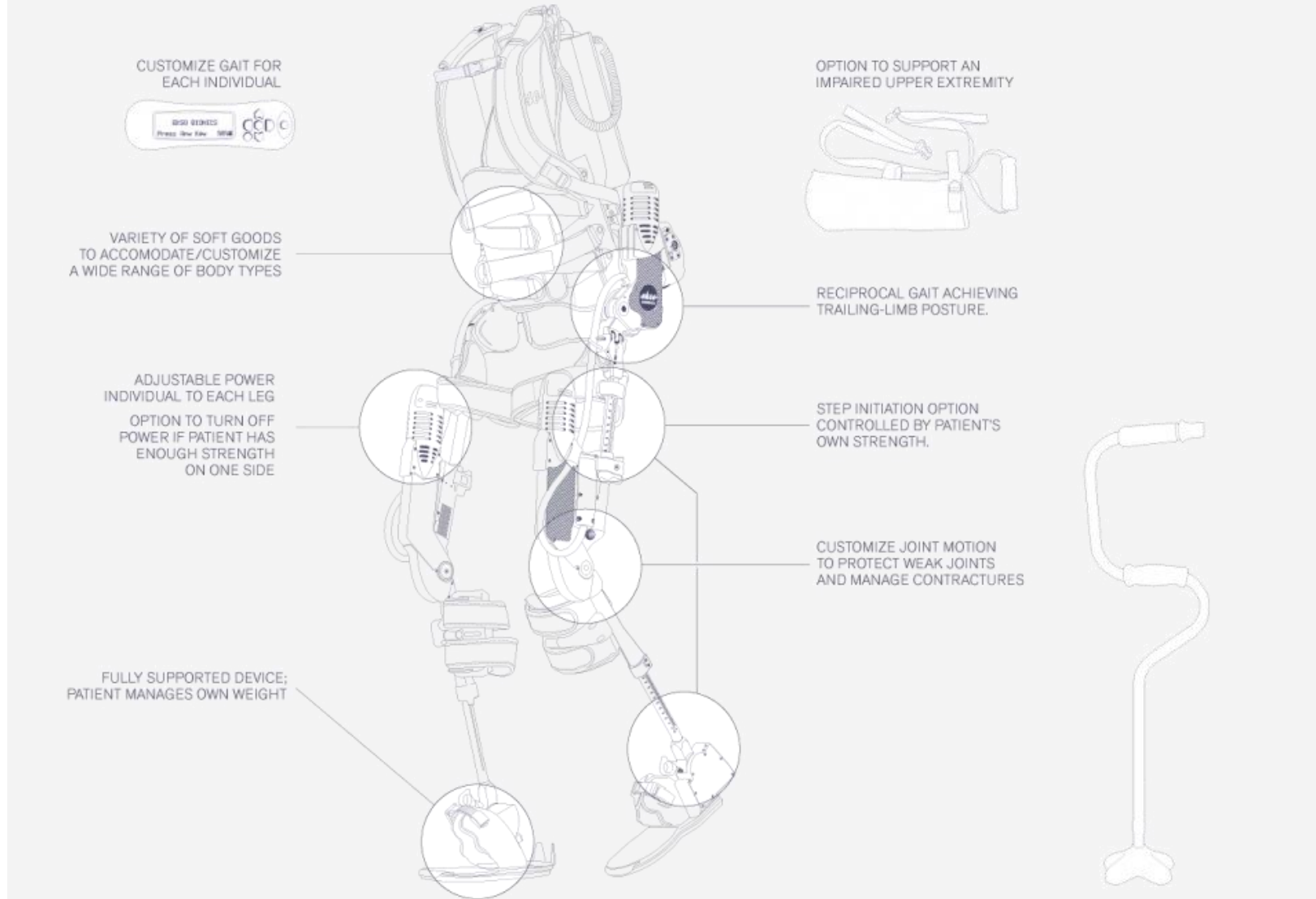
Ekso in Action with Fernanda (2016)



- <https://youtu.be/NuwKS4FkzIE?t=3894>



Other Features



Careers in Exoskeletons



- Engineering
 - Mechanical
 - Electrical
 - Software / Controls
 - Manufacturing
 - Soft goods
 - Regulatory
- Operations
 - Supply chain management
 - Assembly
 - Service
- Customer Support
 - Shipping
- Clinical
 - Physical Therapist
 - Orthotist
- G&A
 - Sales
 - Marketing
 - Finance
 - Management
 - HR

Thank you

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