Transforming How We Physically Integrate Exoskeletons With The Human Body To Augment Movement

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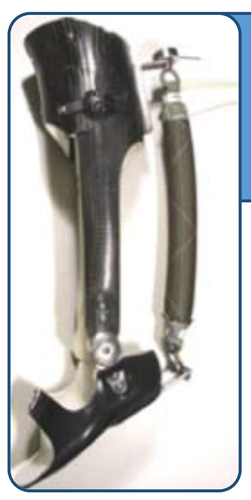
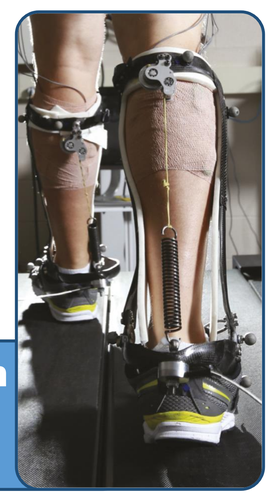
Exoskeletons can Restore Mobility and Enhance Human Capabilities…

Indego exoskeleton enables paralyzed individuals to walk [Hartigan 2015]

Soft exosuit reduces the metabolic cost of walking with a load by 7% [Panizzolo 2016]



Ankle exoskeleton reduces metabolic cost and muscle use, and increases total ankle power [Koller 2015]



Unpowered ankle exoskeleton reduces the metabolic cost of walking by 7% [Collins 2015]

…But Current Physical Interfaces Limit Exoskeleton Performance Benefits

Exoskeleton Force Transmission Issue

- Axial limb loading → skin-tissue stretch, migration of interface [Asbeck 2013]
- Orthogonal limb loading → soft tissue compression [Pons 2010]

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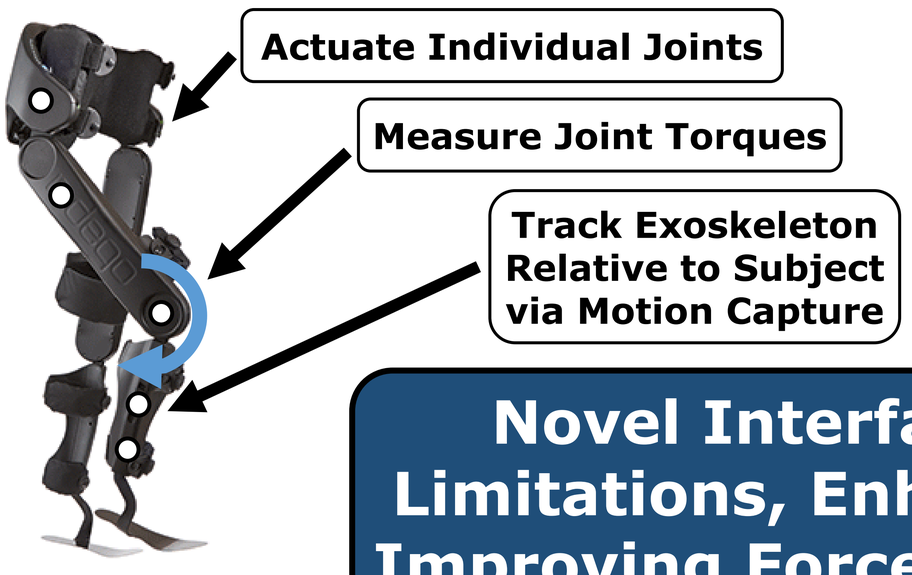
Exoskeleton Power Transmission Issue

- As much as 50% of power may be lost during transmission to the body [Cherry 2015] due to deformation of soft tissue and interface materials, and to relative motion of interface with respect to the body.

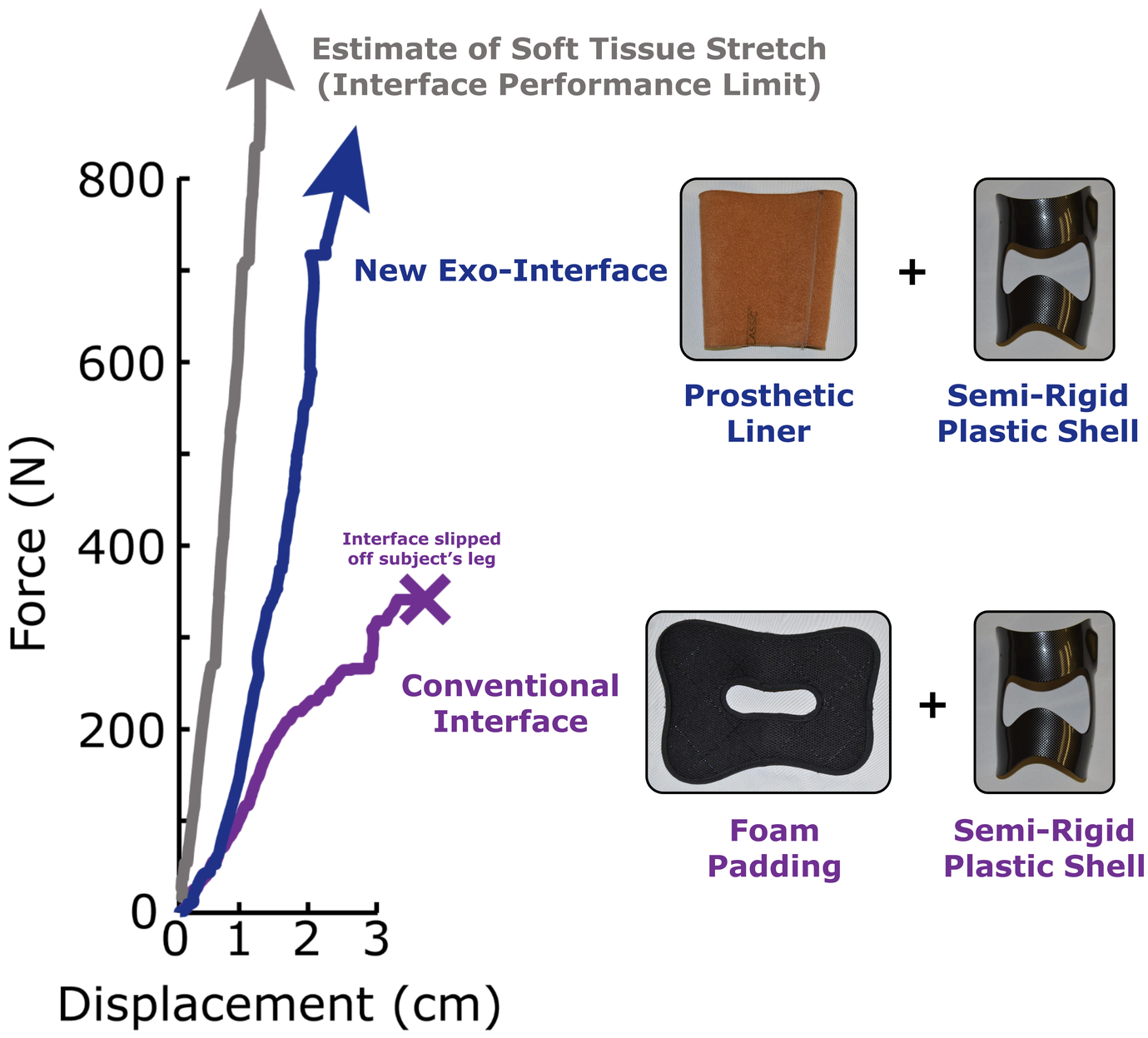
Advanced Interfaces could Resolve Force and Power Transmission Issues

Approach: Isolate and Quantify Human-Exoskeleton Interface Dynamics (Axial Limb Loading)

Future: Extend Methods to Study Exoskeletons with Orthogonal Limb Loading Attachments



Results: Innovative Exo-Interfaces can Increase Axial Load-Bearing Capabilities



Novel Interfaces could Overcome Current Limitations, Enhancing Exoskeleton Benefits by Improving Force and Power Transfer to the User

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