

# Design of a Low-cost Unilateral Hip Brace for Gait Training

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## PURPOSE

- To present the development of a passive unilateral hip brace for gait training
- Long-term objective: use the hip-brace to influence asymmetric gait patterns by introducing errors

## INTRODUCTION

- Many individuals with neurological diseases (e.g., Multiple Sclerosis or Stroke) experience asymmetric walking gait patterns [1,2]
  - ➔ Reduced overall preferred walking speed
  - ➔ Reduced lower extremity ROM (affected limb)
  - ➔ Reduced step lengths (affected limb)
- Robotic exoskeletons (wearable devices) successfully influenced the kinetics and kinematics of walking gait [3,4]
  - ➔ However, the cost of materials, the time to set-up such devices, and the time to prepare subjects themselves is significant
- Passive exoskeletons reduce the price of materials and offer a less-time consuming method for influencing gait
  - ➔ Offers the possibility of wearing the device for an extended period outside of a lab environment
- “Error augmentation” offers a promising avenue to treat asymmetric gait patterns
  - ➔ Increasing walking errors (i.e., moving limbs from their normal trajectories) [4]
  - ➔ The brain develops new patterns (neural motor pathways) through error – providing an interesting research avenue for new rehabilitation protocols [3,5]

## METHODS

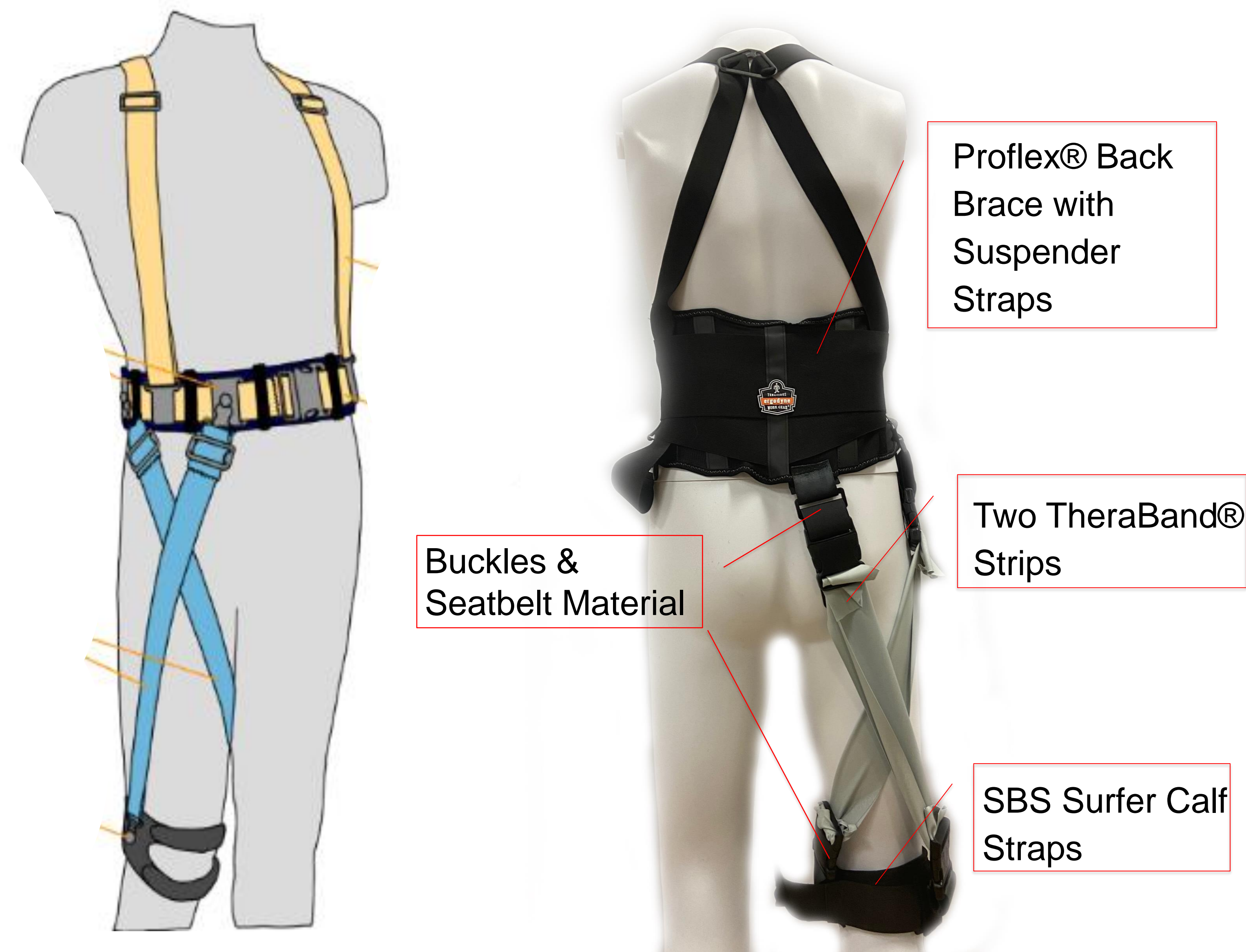


Figure 1: Example of a previous design (left) of a unilateral exoskeleton and the design of the proposed exoskeleton (right) [2]

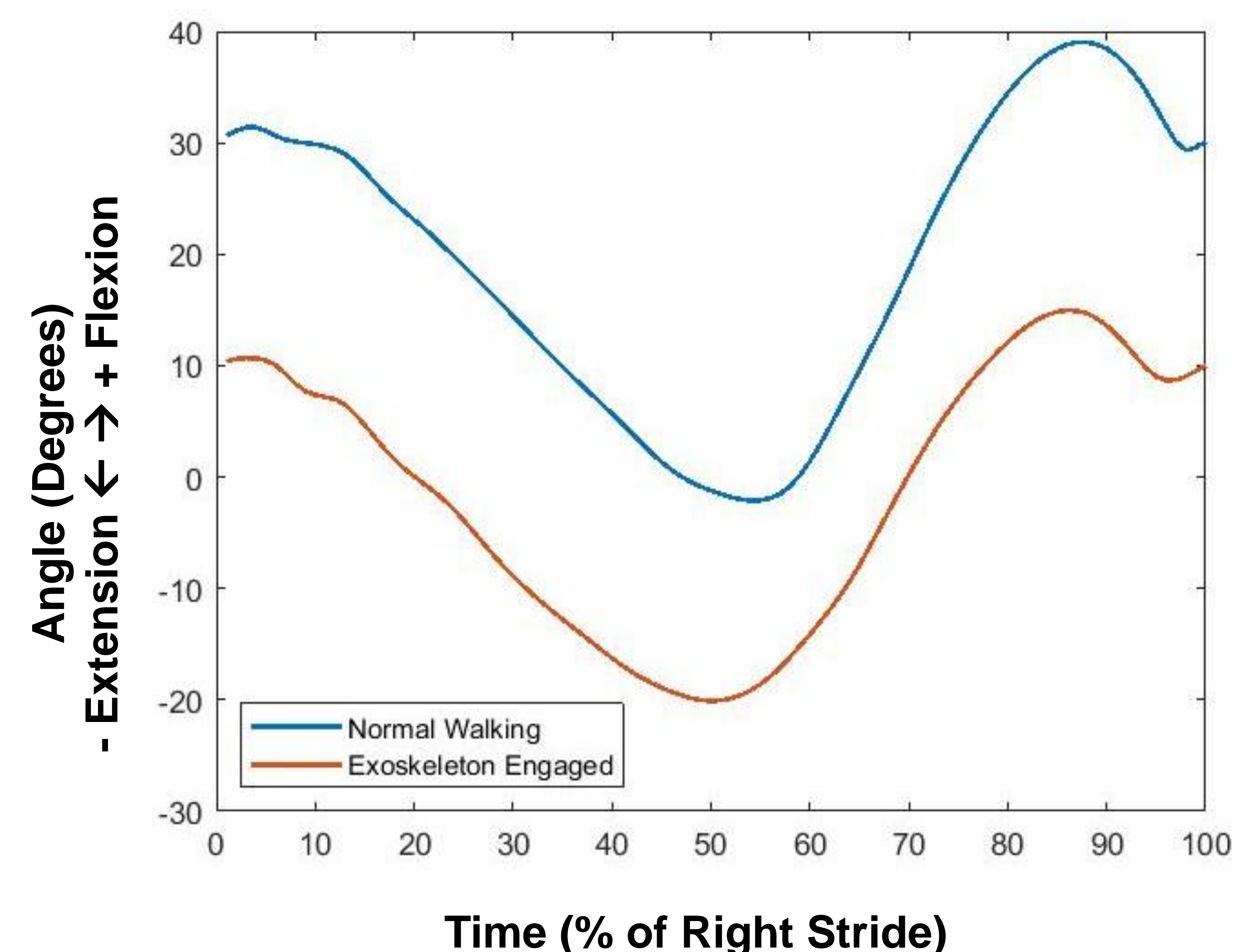


Figure 2: Hip Flexion and Extension Angles from Pilot Test with Proposed Exoskeleton

## RESULTS & DISCUSSION

### Basis for Brace Design

- The brace design is based on a previous research design by Neuman et al. seen in Figure 1 on the left
- The device successfully **assisted** hip flexion in Multiple Sclerosis patients – displaying the designs effectiveness [2]

### Planned Use for Error Augmentation

- Bands will be stretched past optimum actuation pretension
  - ➔ Increases errors experienced at the hip during walking
- Providing suboptimal actuation assistance was found to impede walking [6]
- Using the bands to create more errors rather than for assistive purposes establishes a method to impose error augmentation on walking gait
- The bands seen in Figure 1 resist hip flexion during walking gait
- Pilot data shows that the passive brace successfully resists hip flexion during walking
  - ➔ We expect that, once removed, exaggerated hip flexion will occur – possibly restoring symmetry

## REFERENCES

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