# Improving walking symmetry in people with stroke: a pilot study

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# Stroke

- Occurs when blood flow to a part of the brain stops
- Brain cells die without access to blood and oxygen
- Causes permanent damage to one side of the brain, resulting in motor impairments to the other half of the body

# Walking asymmetry

- Hallmark characteristic of stroke patients (Patterson et al., 2008)

1. Weaker leg spends less time in single-support stance phase (Beauchamp et al., 2009)
2. Weaker leg has a shorter stride length (Reisman et al., 2007)

**Weaker Leg = Less SUPPORT and Less PROPULSION**

# Why does it matter?

- Walking asymmetry leads to:
  - Impaired balance (Platts et al., 2006)
  - Decreased bone strength (Jorgenson et al., 2000)
  - Joint problems (Patterson et al., 2008)
  - Increased falls (Poole, 2002)

# Aim

- To improve walking symmetry by increasing the use of the weaker leg
- **How?**
- By placing resistance (more weight) against the stronger leg, making it harder to use

# Hypothesis

- When resistance is applied against the stronger leg, the weaker leg will be used more

- Increased single-support stance time of the weaker leg
- Increased stride length of the weaker leg

# Methods

# Participants

- 6 people with stroke
  - Ambulatory
  - All subjects gave written informed consent

# Equipment

- Lokomat gait therapy device

# Equipment

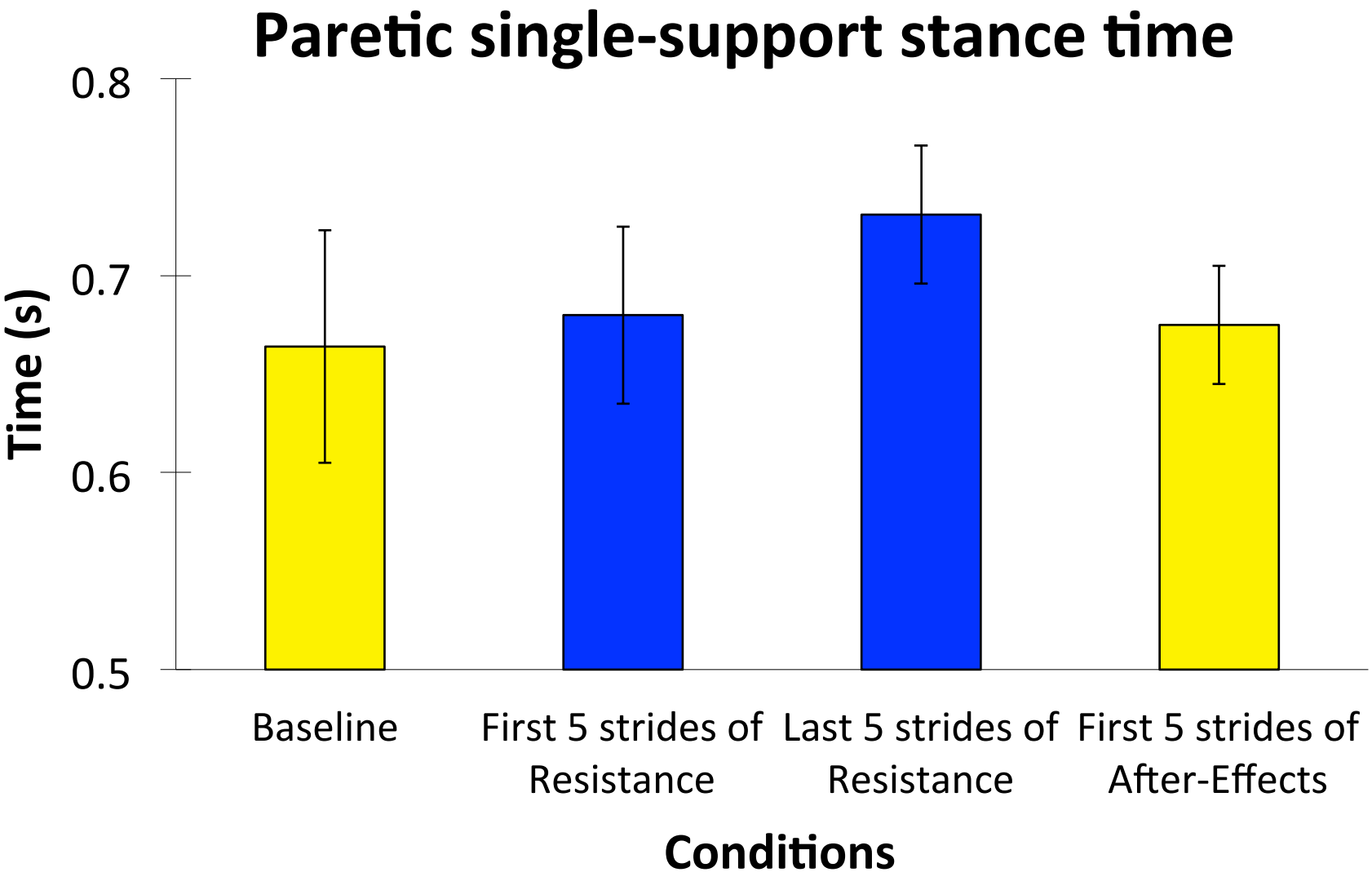
- Lokomat
- Force-sensitive resistors (FSR)
  - Placed under feet
  - Detect when feet are on ground to measure length of time spent in single-support stance
- Motion capture cameras
  - Placed infrared markers on feet
  - Record foot trajectory to measure stride length

# Protocol

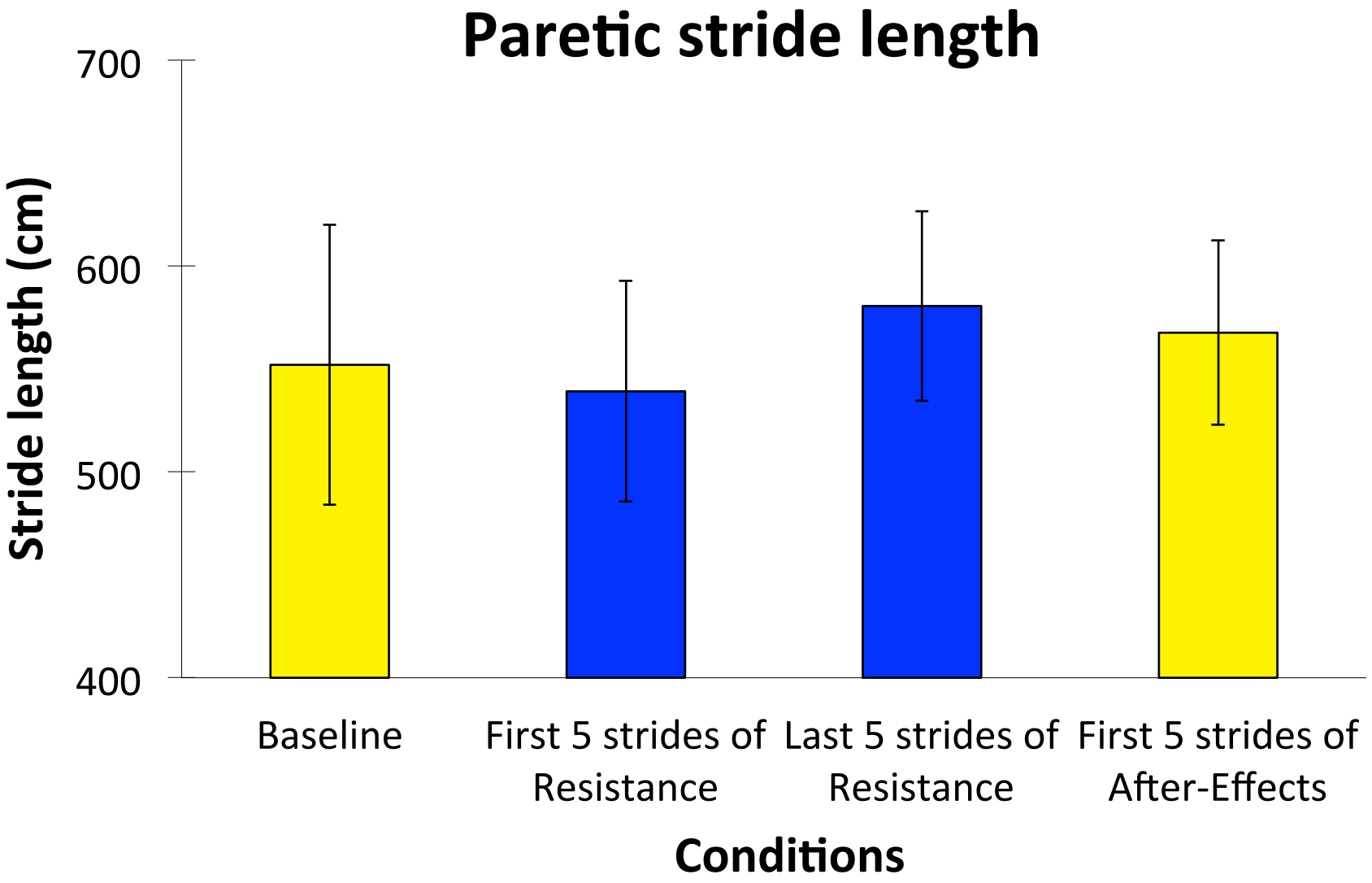
- Participants walked consecutively for:
  - 50 strides with no resistance
  - 50 strides with resistance against the stronger leg
  - 50 strides with resistance removed
- Resistance was scaled to 10% of the individual's hip and knee flexors' maximal voluntary contraction

# Results

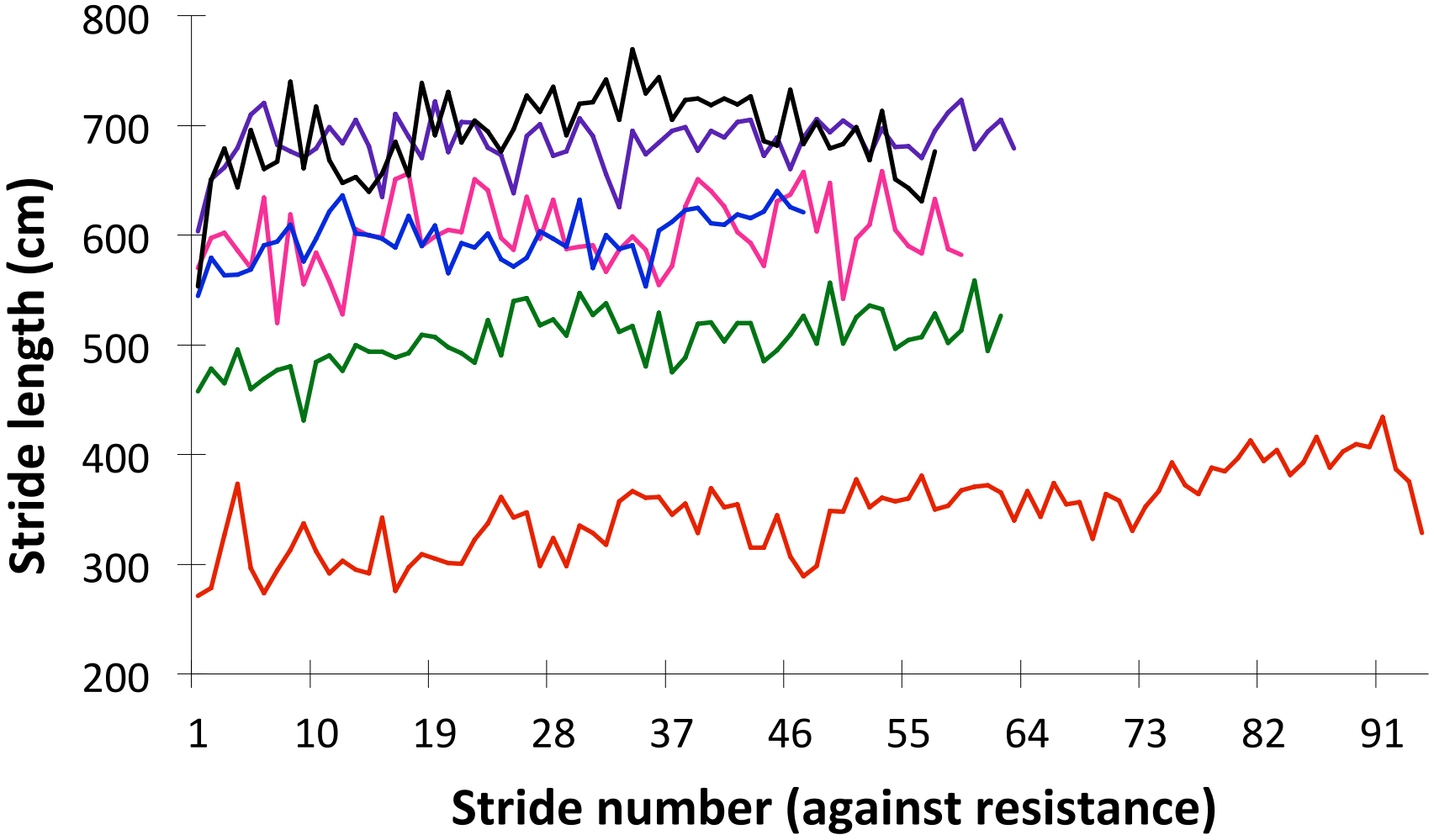
When resistance is applied, the weaker leg will have increased single-support stance time



# When resistance is applied, the weaker leg will have increased stride length



# Paretic stride length (adaptation to resistance)



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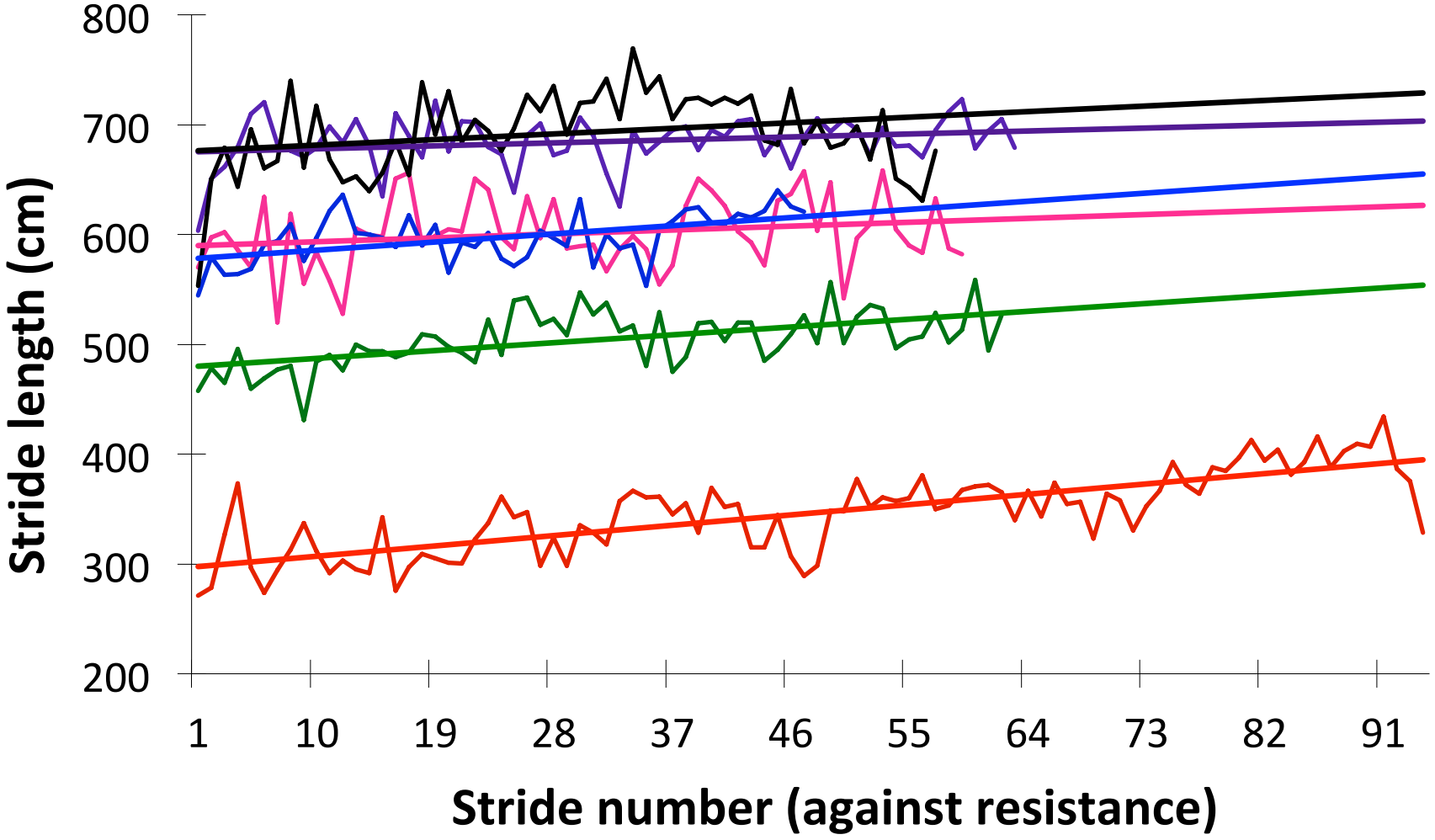

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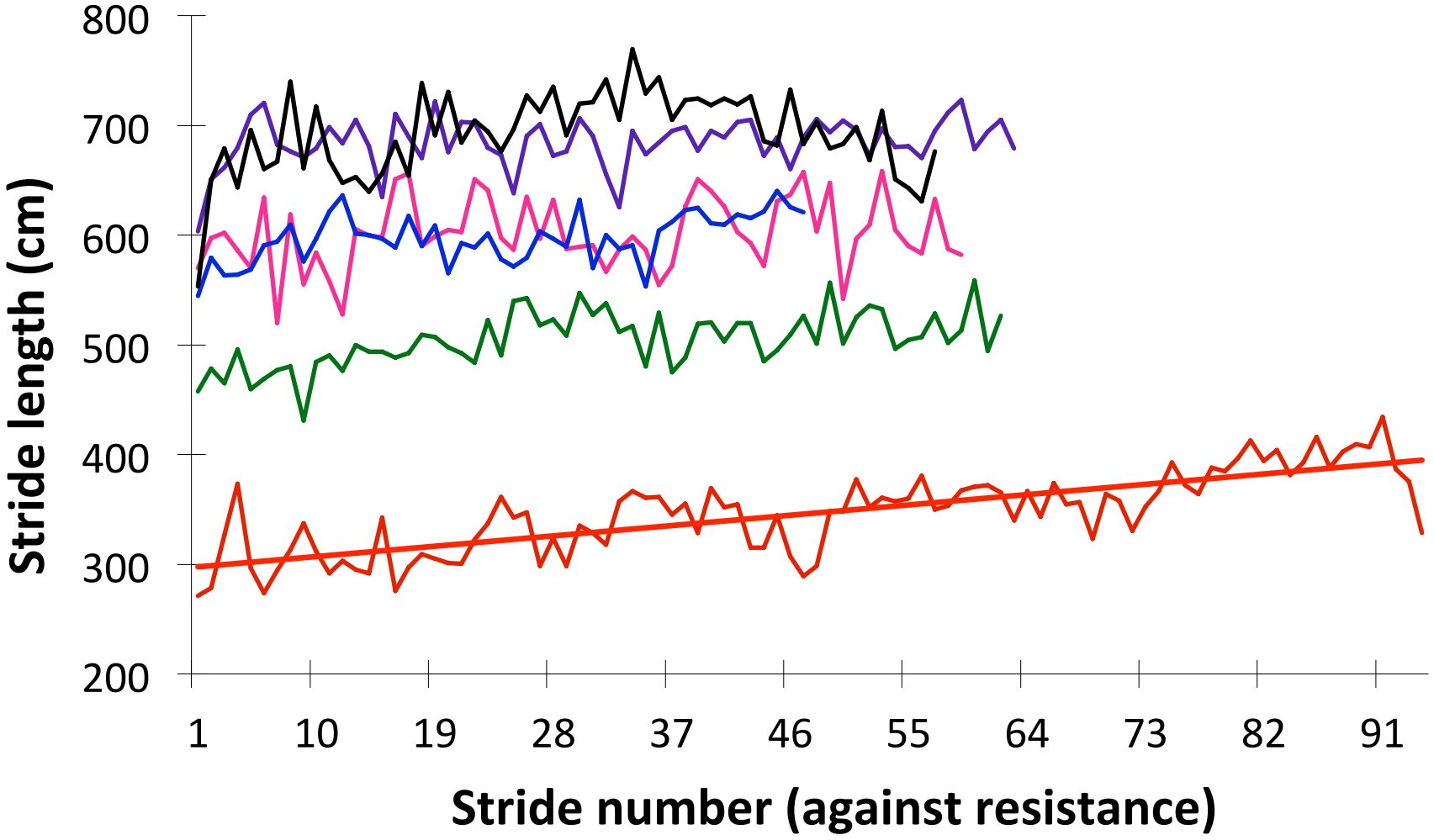
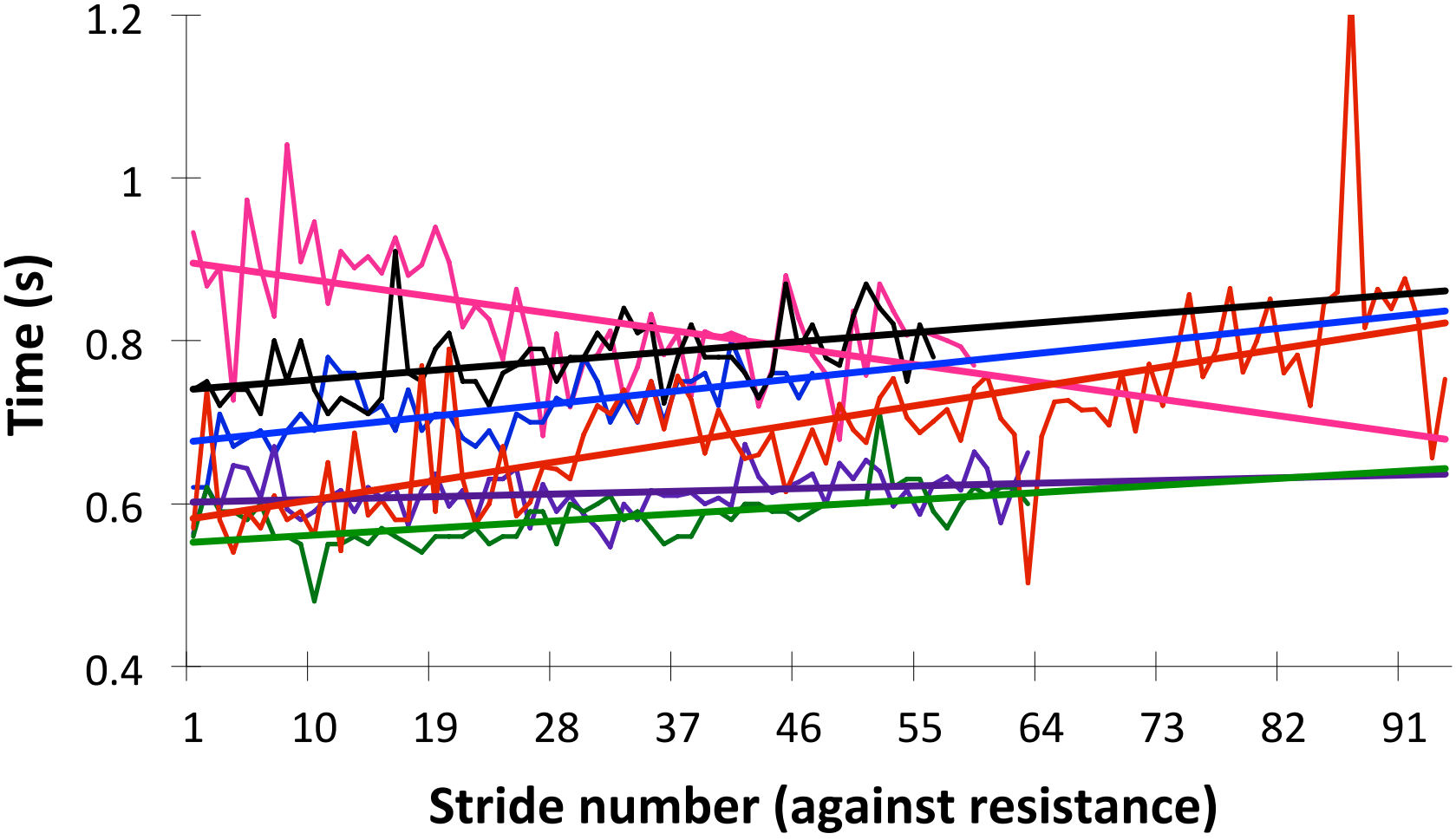
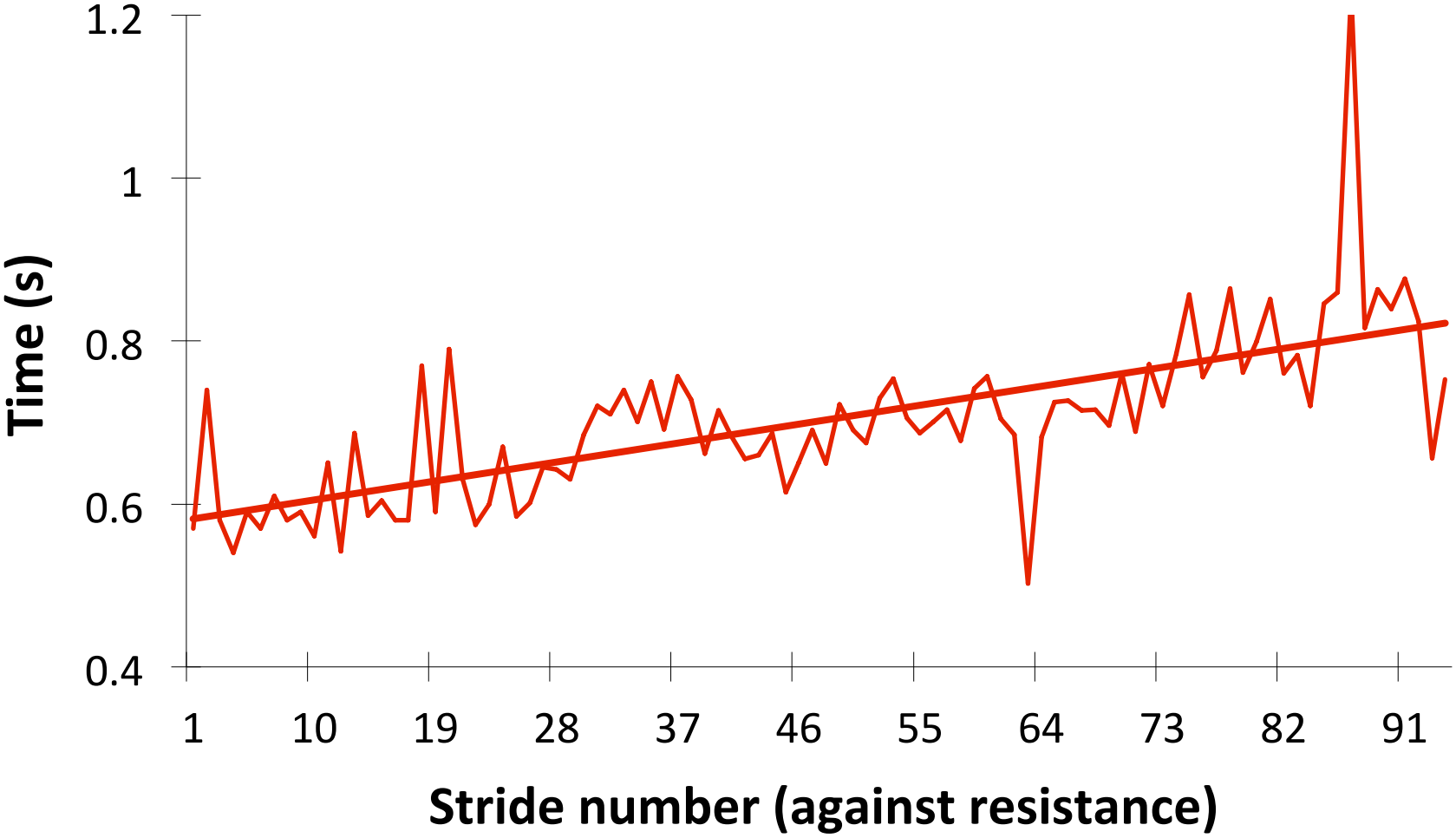


# Paretic single-support stance time (adaptation to resistance)



# Paretic single-support stance time (adaptation to resistance)



# Paretic single-support stance time (adaptation to resistance)

# Conclusions and Future Directions

# Conclusions

1. Applying resistance to the stronger leg can increase the use of the weaker leg to propel and support the body during walking
2. Aspects of the study design can be improved
   - More than 50 strides of walking against resistance may be required
   - Verbal cueing to ensure that participant responds in the intended way to training

# Future Directions

- More research on this novel intervention to improve walking symmetry in people with stroke
- Use the knowledge and experience gained from this pilot study to inform a larger study

# References

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# Thank you!

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