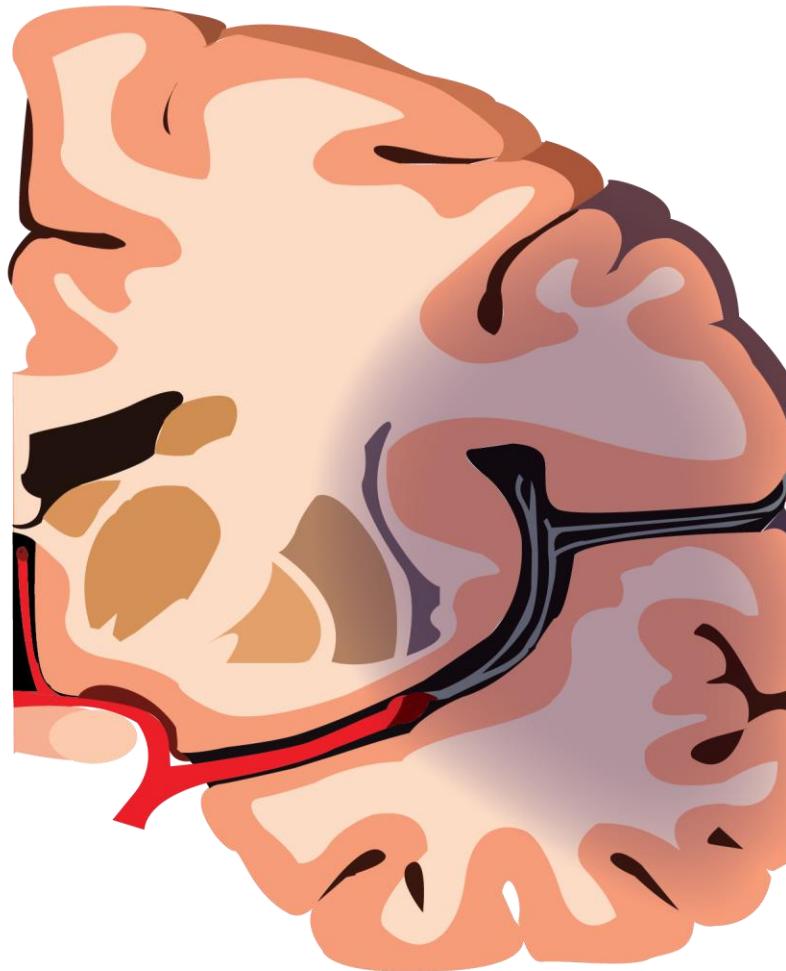


# Delayed Muscle Activity in Stroke Survivors with Upper-Limb Hemiparesis



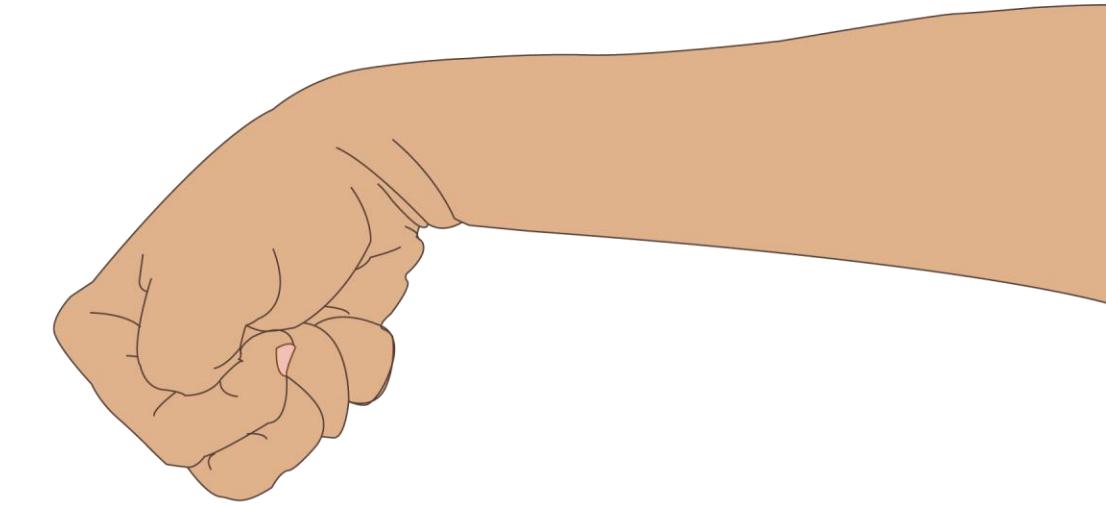
D. Lopez, C. Thomson, F. Mino, S. Edgely, P. Maitre, M.  
Iversen, J. George

# STROKE AND SUBSEQUENT HEMIPARESIS IS COMMON



~1 in 4 people will have a stroke in their lifetime<sup>1</sup>

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55 – 75% of stroke survivors will have residual upper limb hemiparesis<sup>2</sup>

# EXOSKELETONS CAN HELP WITH ADLS FOR A SUBSET OF PATIENTS



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Exoskeleton Qualification  
and Success

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## Exoskeleton Qualification and Success

- 1) Passive range of motion

# EXOSKELETONS CAN HELP WITH ADLS FOR A SUBSET OF PATIENTS



## Exoskeleton Qualification and Success

- 1) Passive range of motion
- 2) Voluntary control of sEMG signal

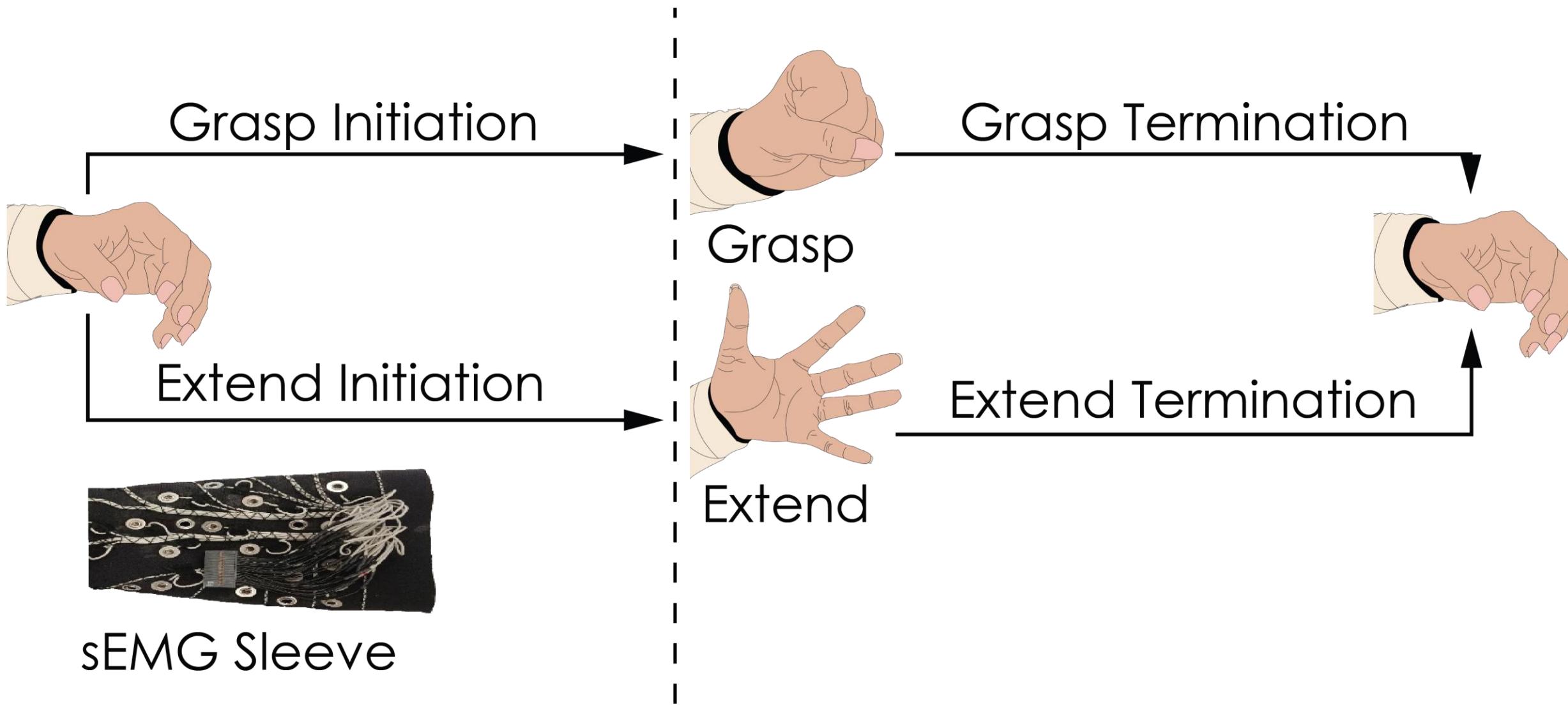
# HOW DOES HEMIPARESIS AFFECT SEMG?



sEMG Sleeve

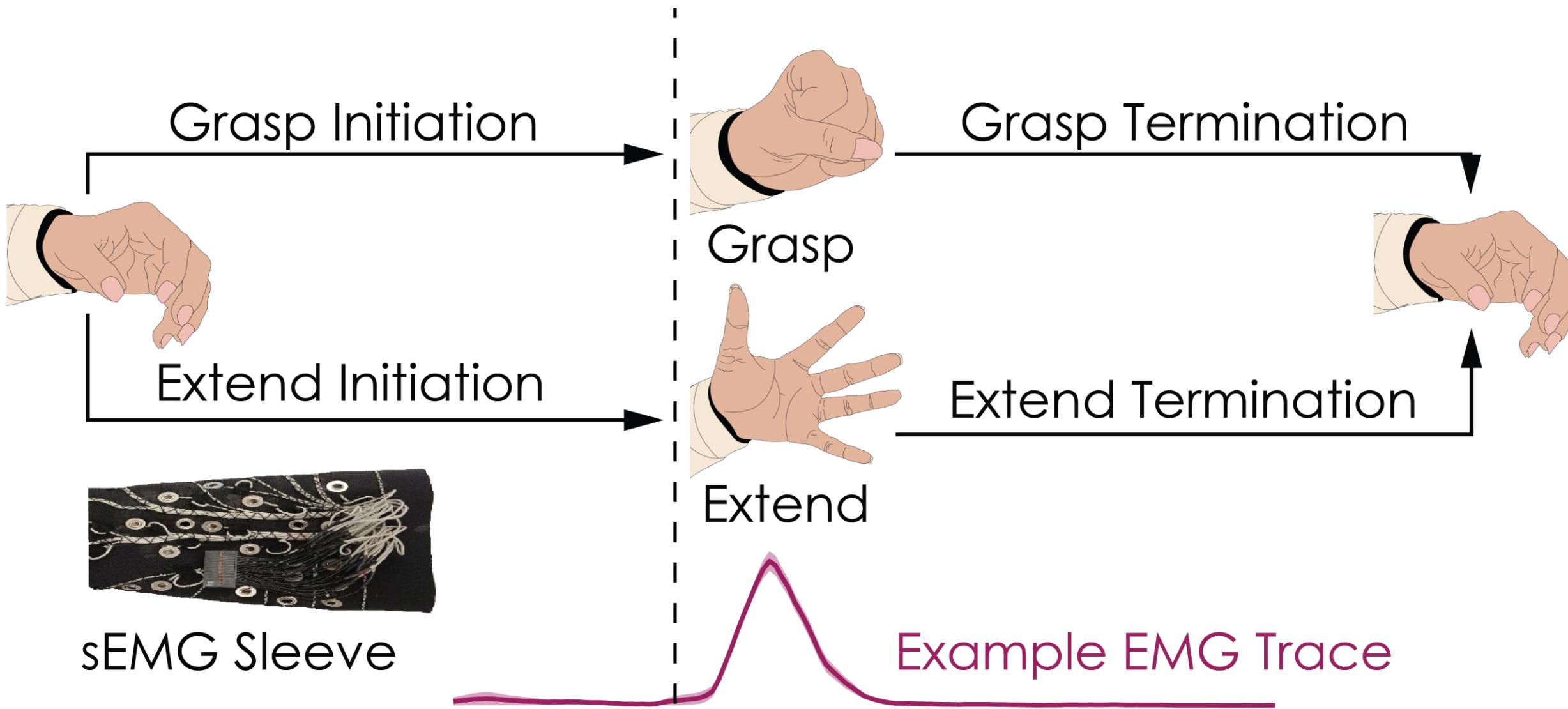
7 participants each – non-paretic hand  
served as an internal control

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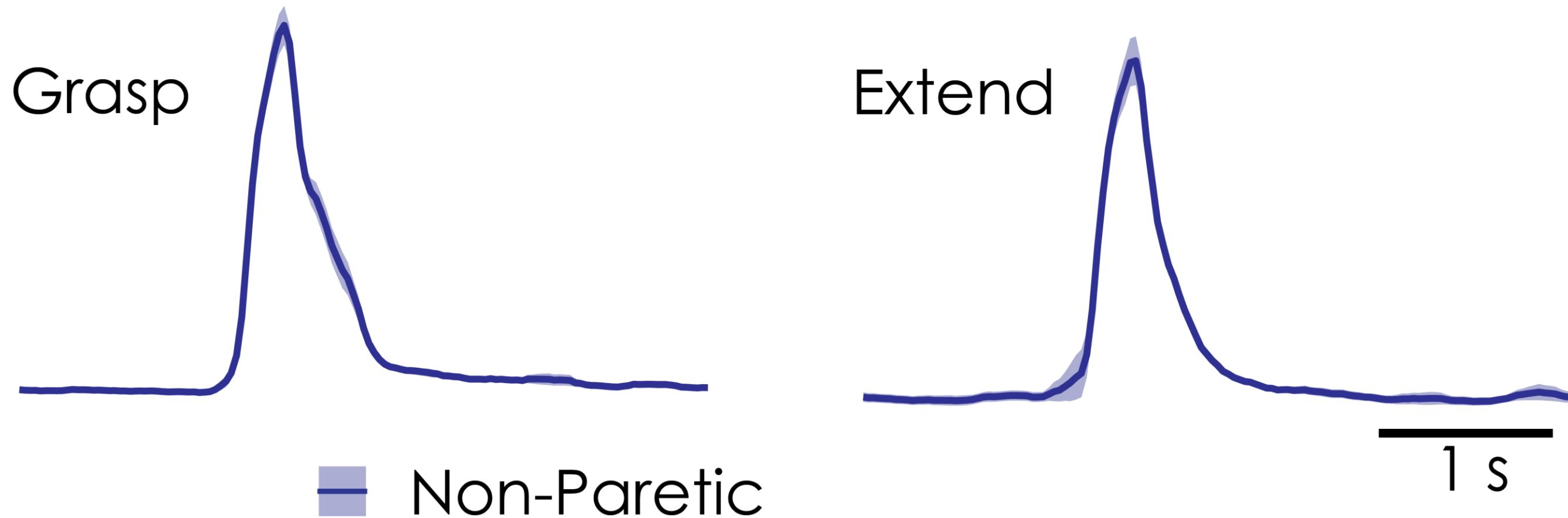
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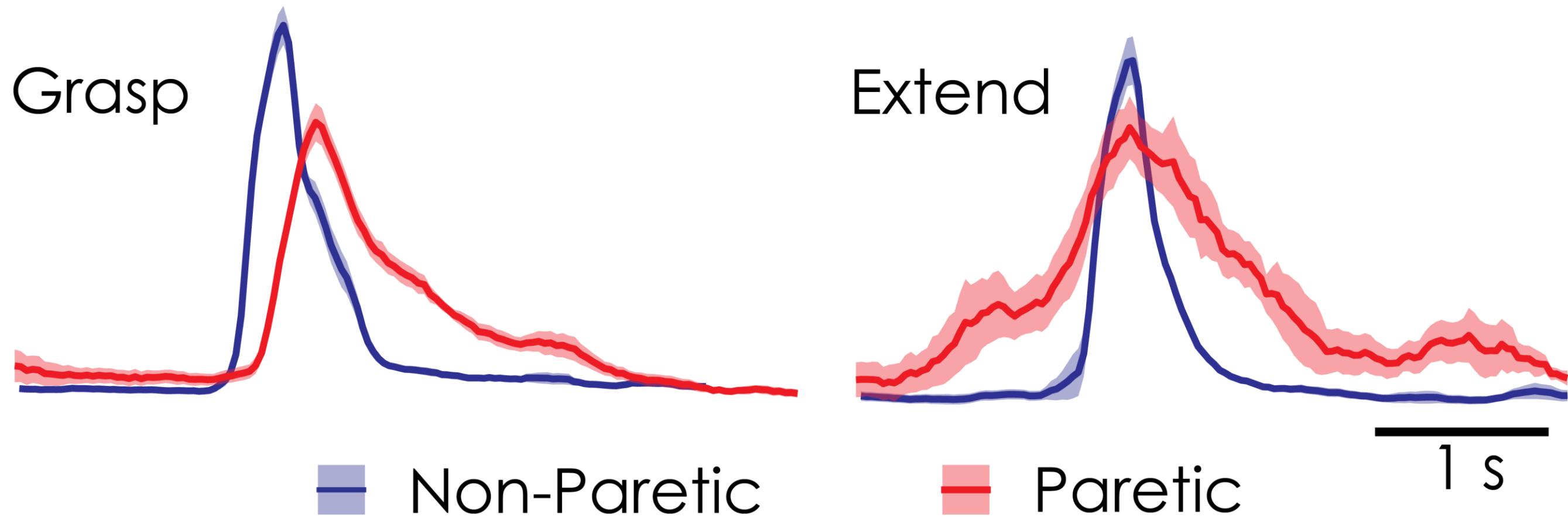


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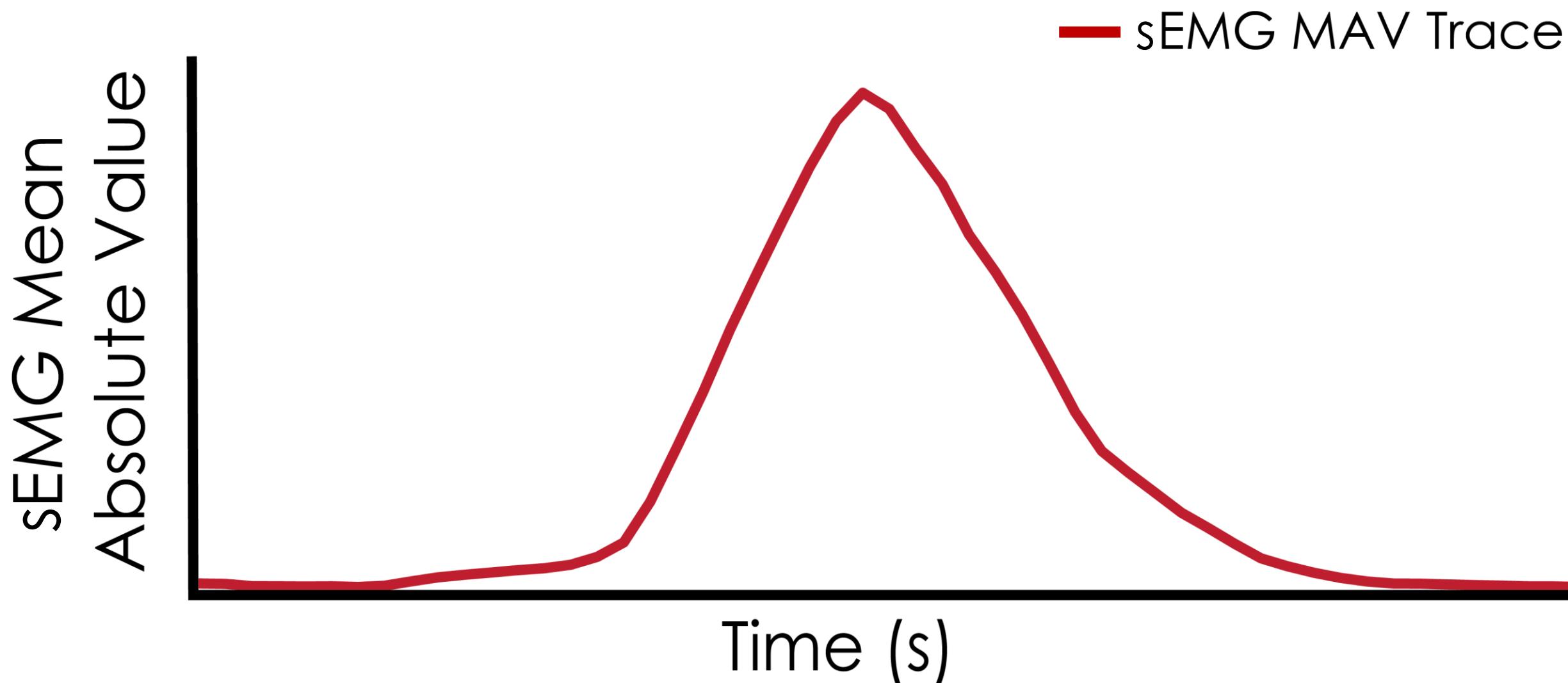
# CLEAR MORPHOLOGICAL DIFFERENCES BETWEEN PARETIC AND NON-PARETIC SEMG



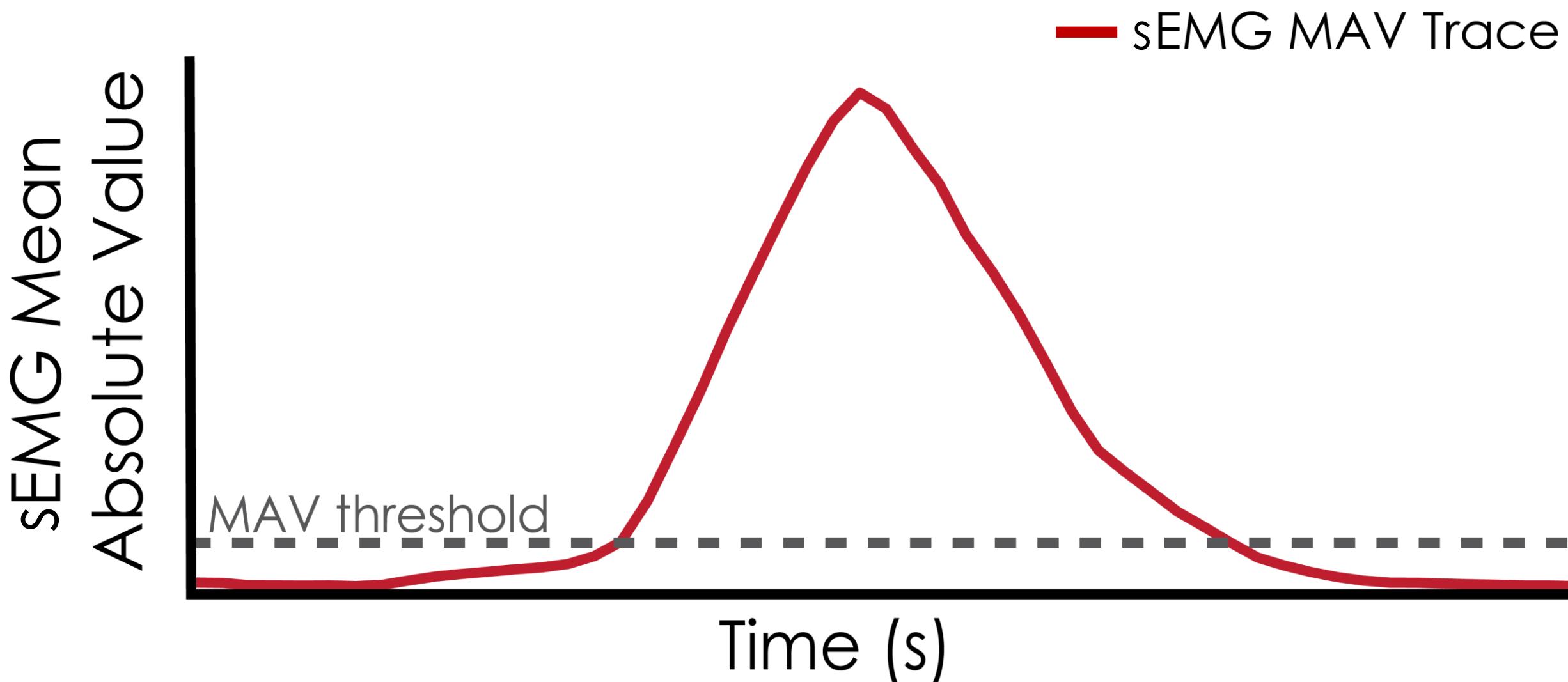
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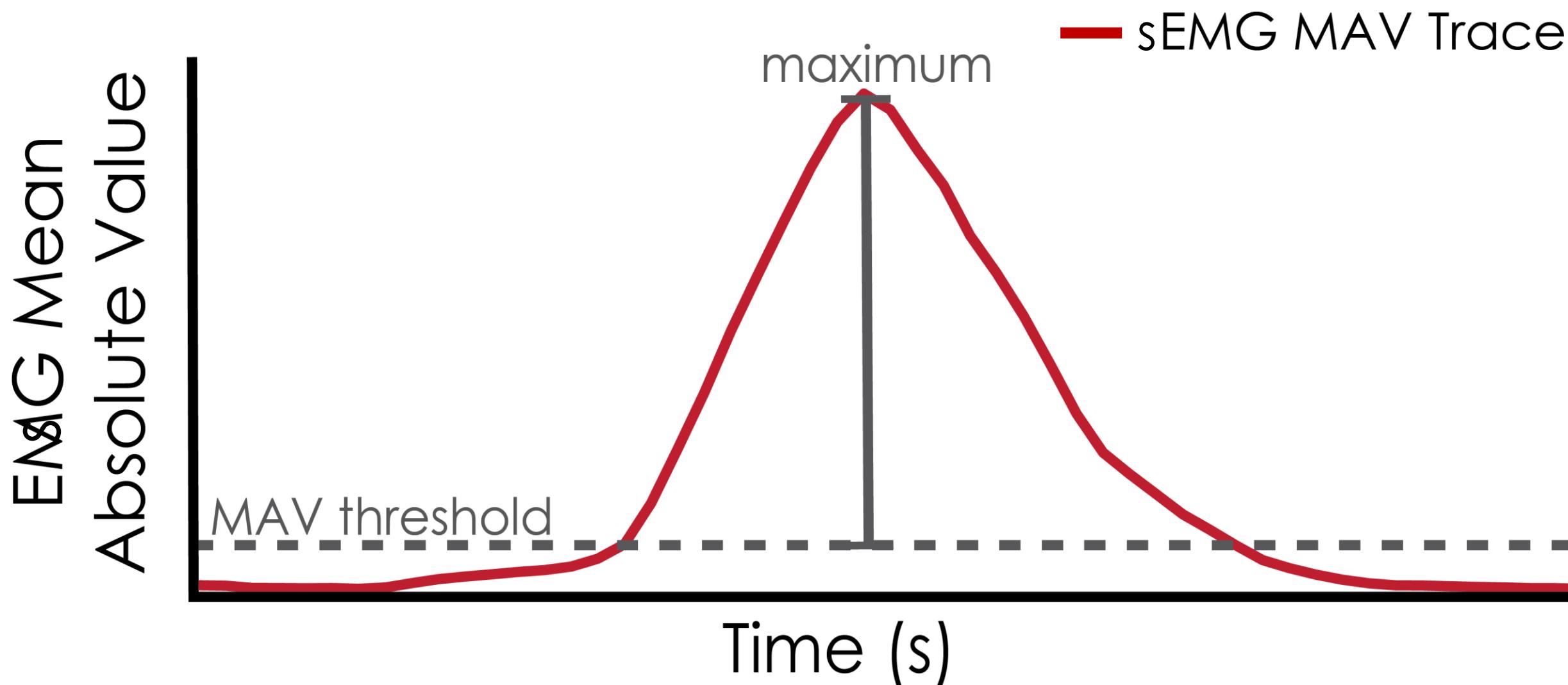
# UNIVERSAL TIME CONSTANT CALCULATION CAN QUANTIFY THE SEMG DIFFERENCE



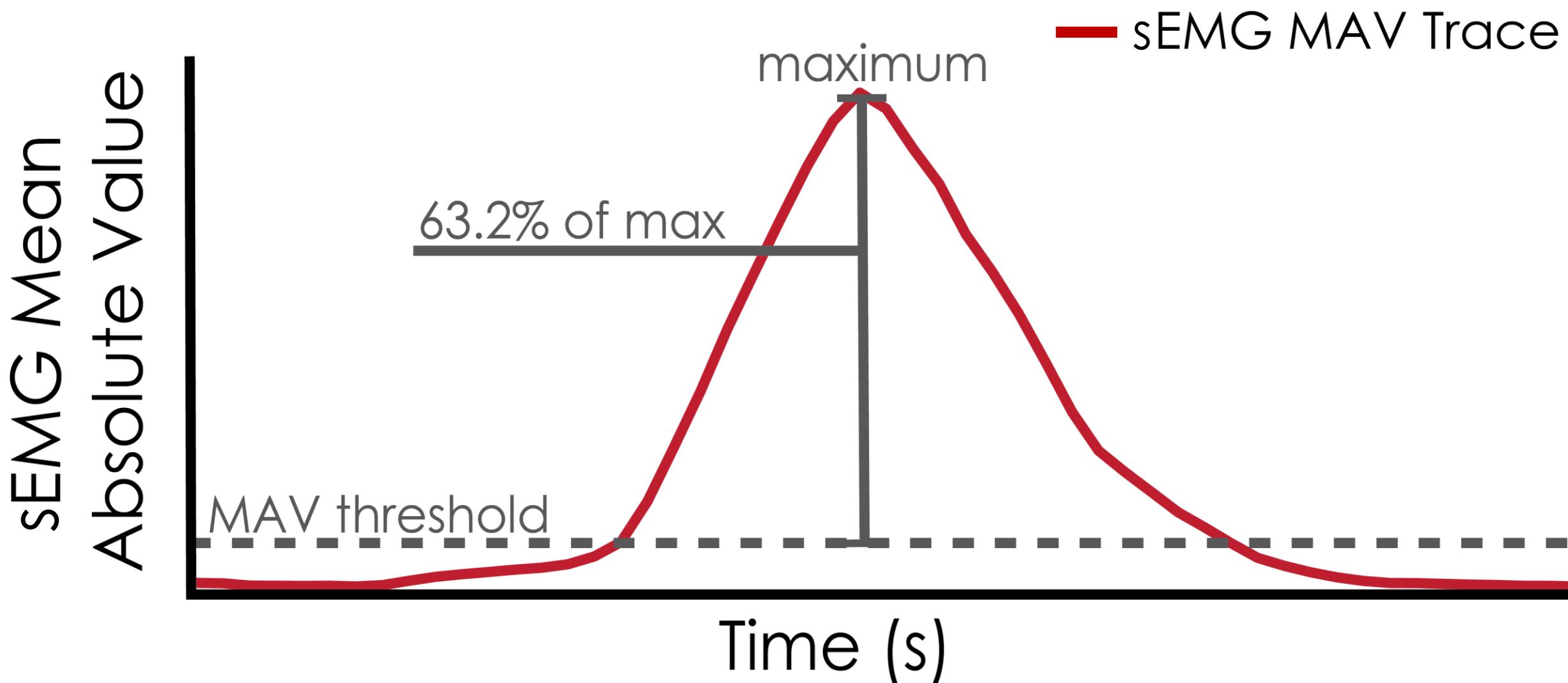
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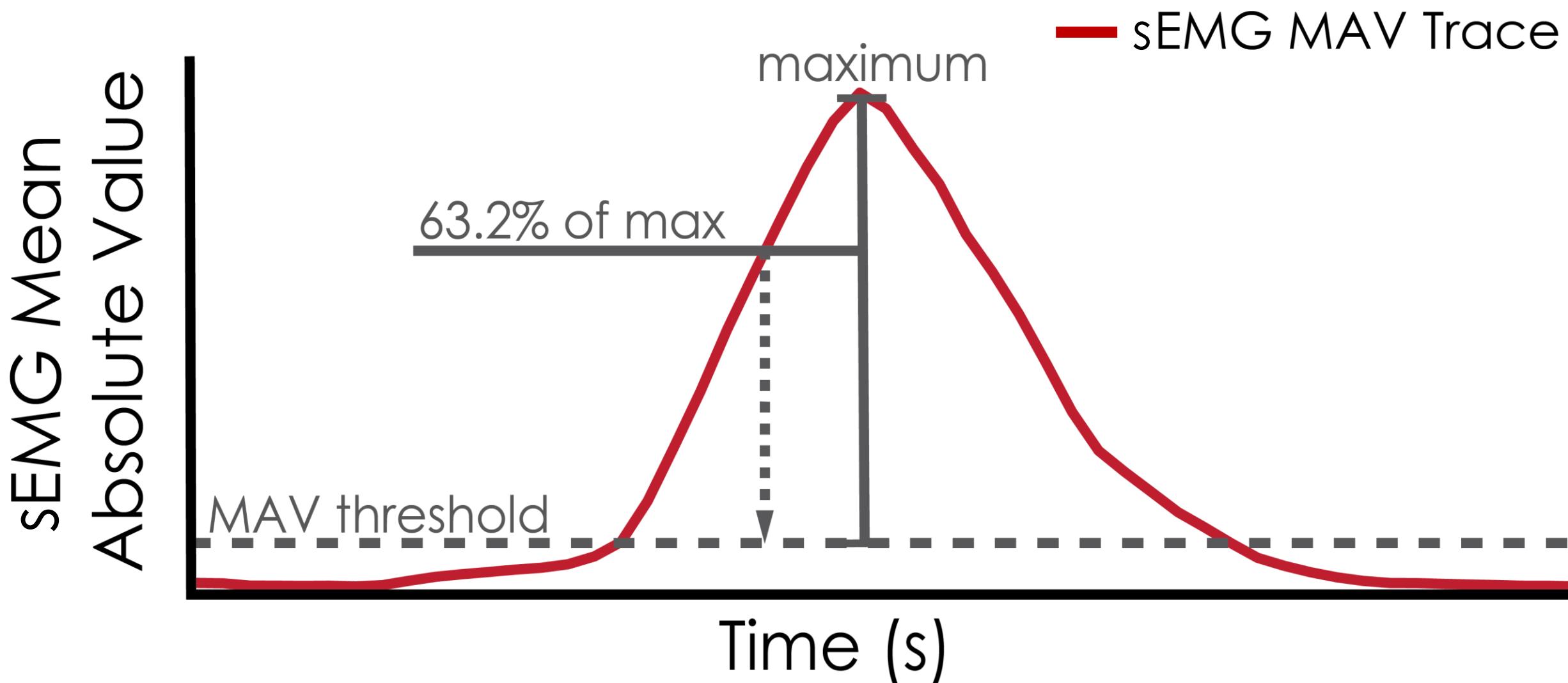
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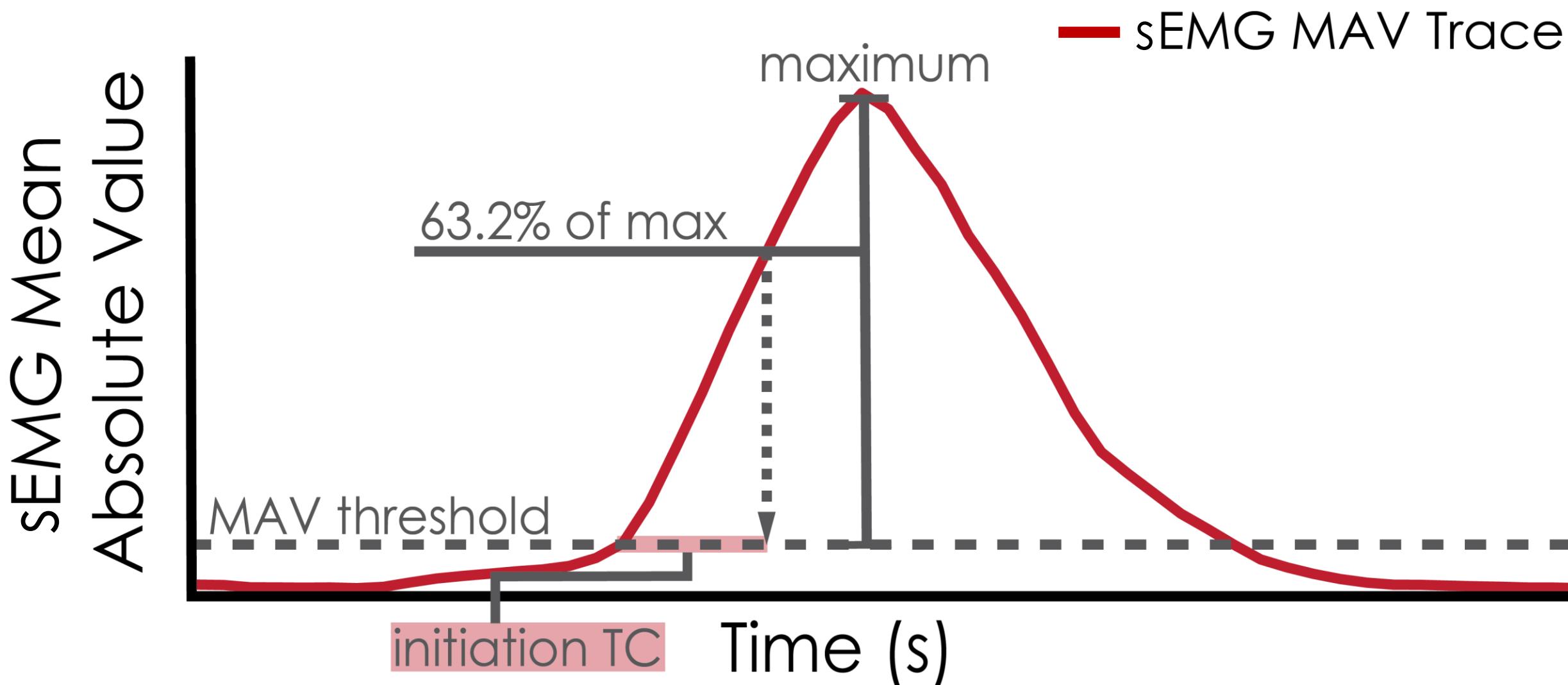
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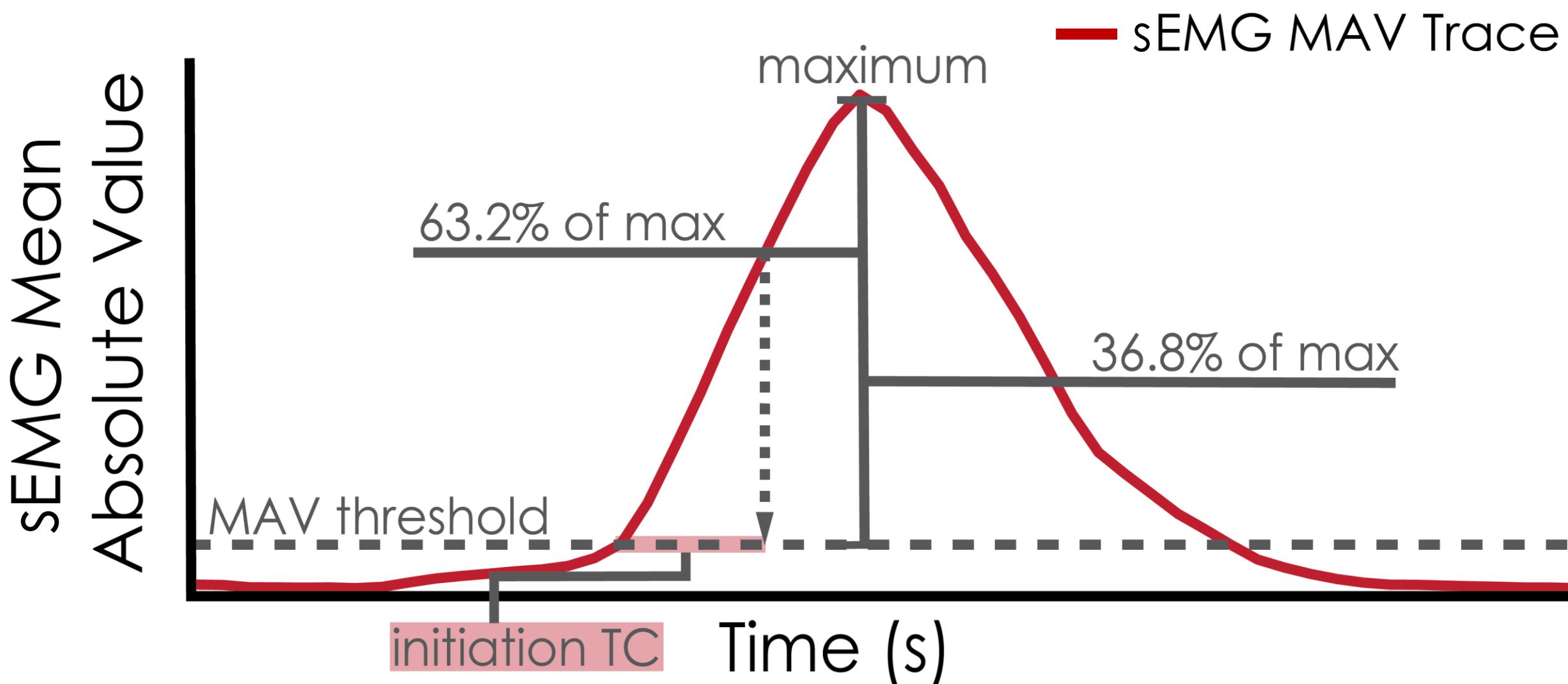
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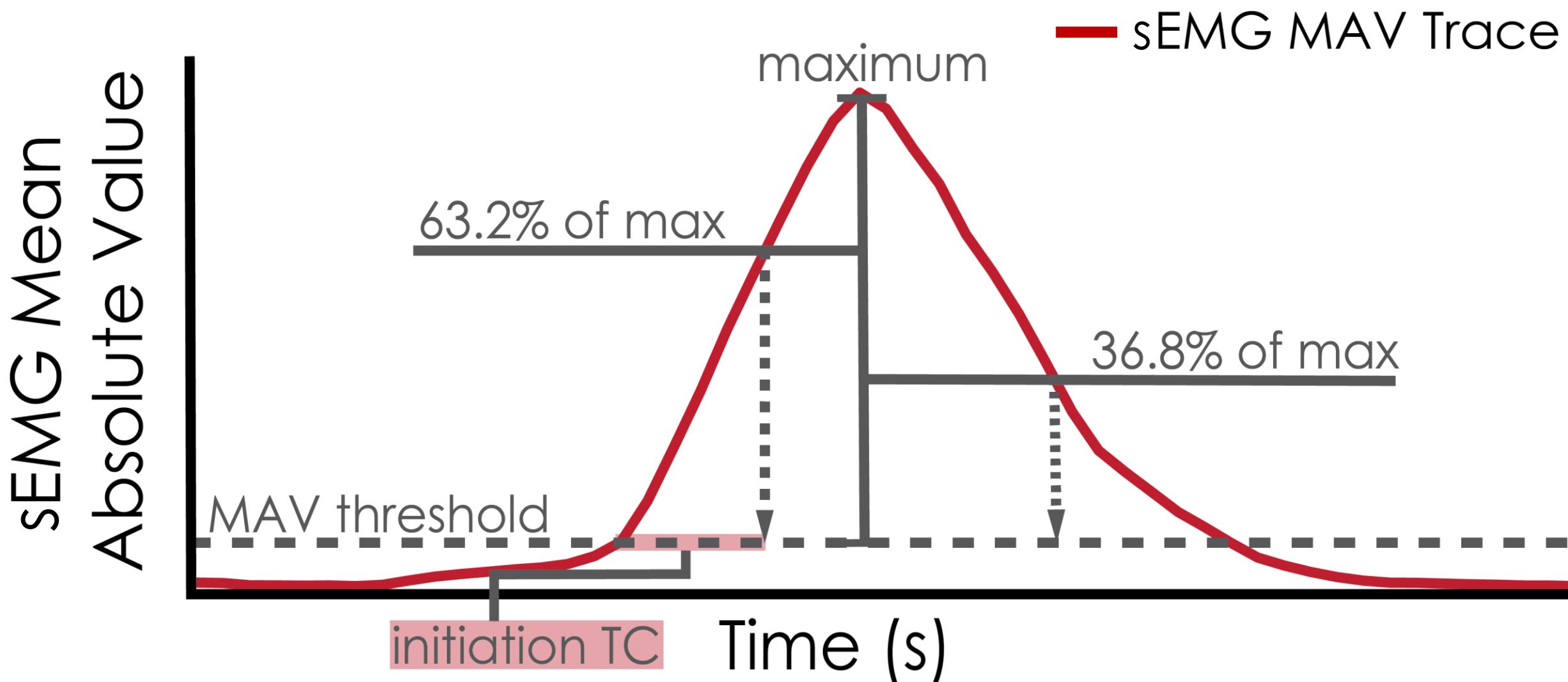
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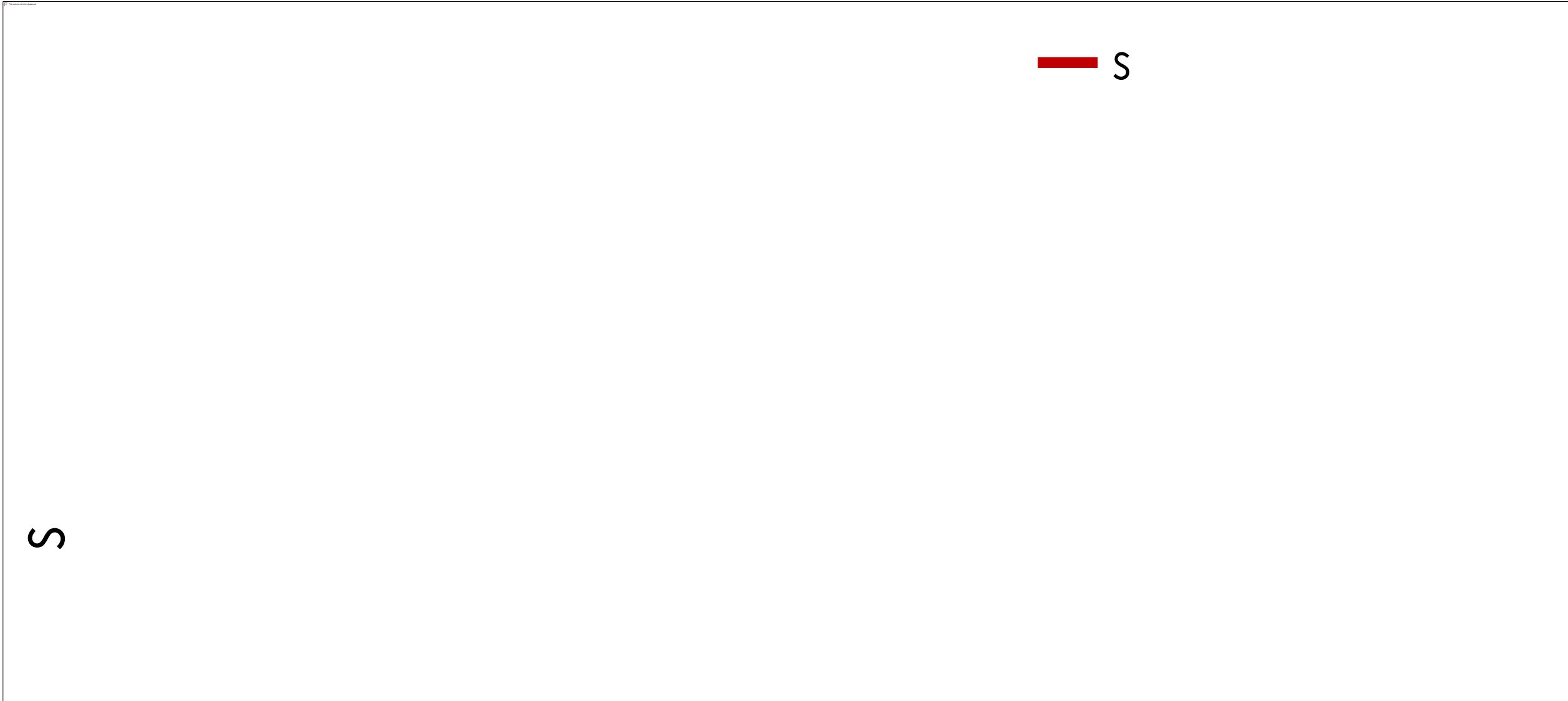
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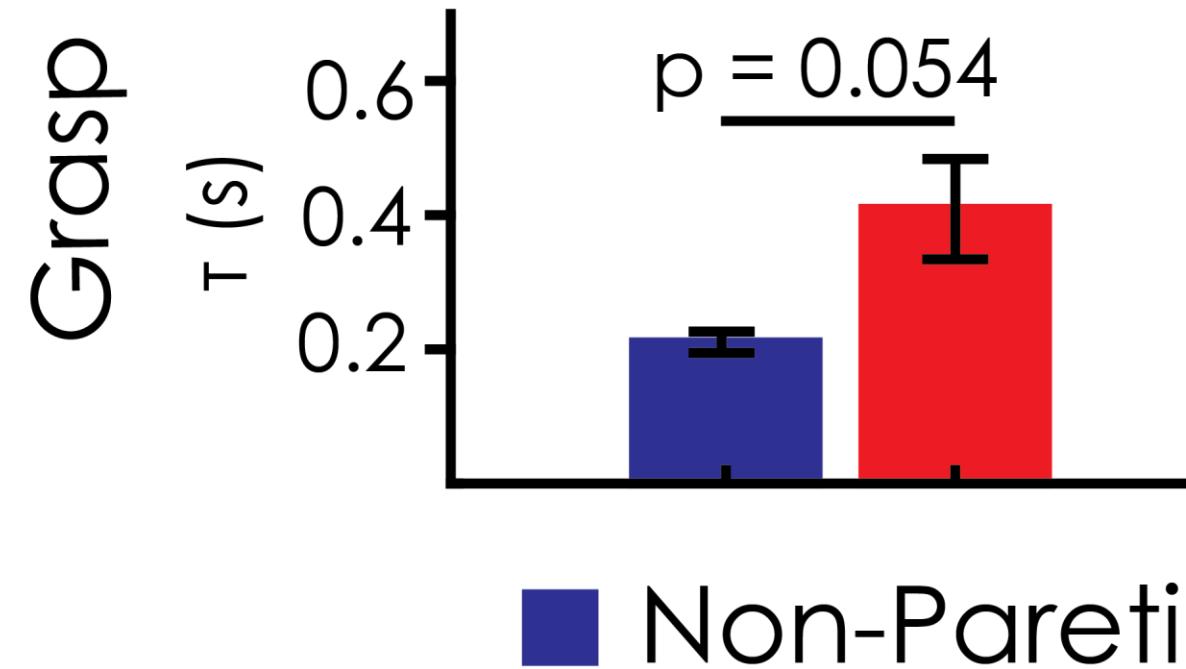


# INCREASED TERMINATION TIME CONSTANTS OF GRASPING ON PARETIC SIDE

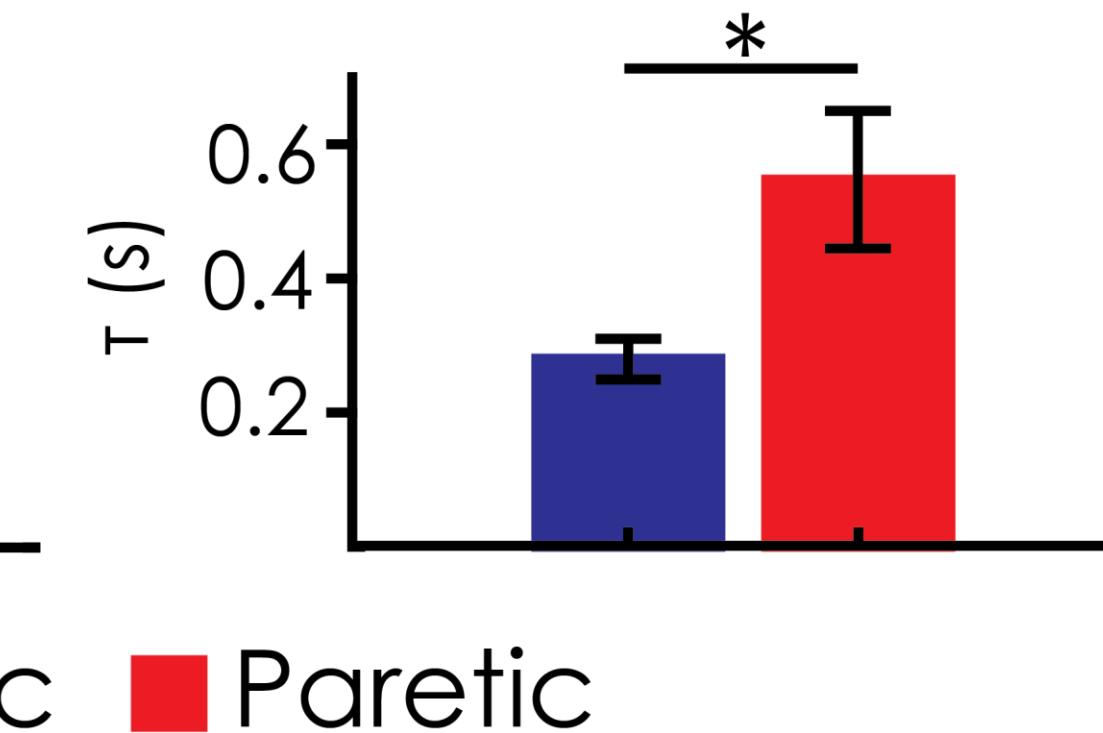


# INCREASED TERMINATION TIME CONSTANTS OF GRASPING ON PARETIC SIDE

Initiation

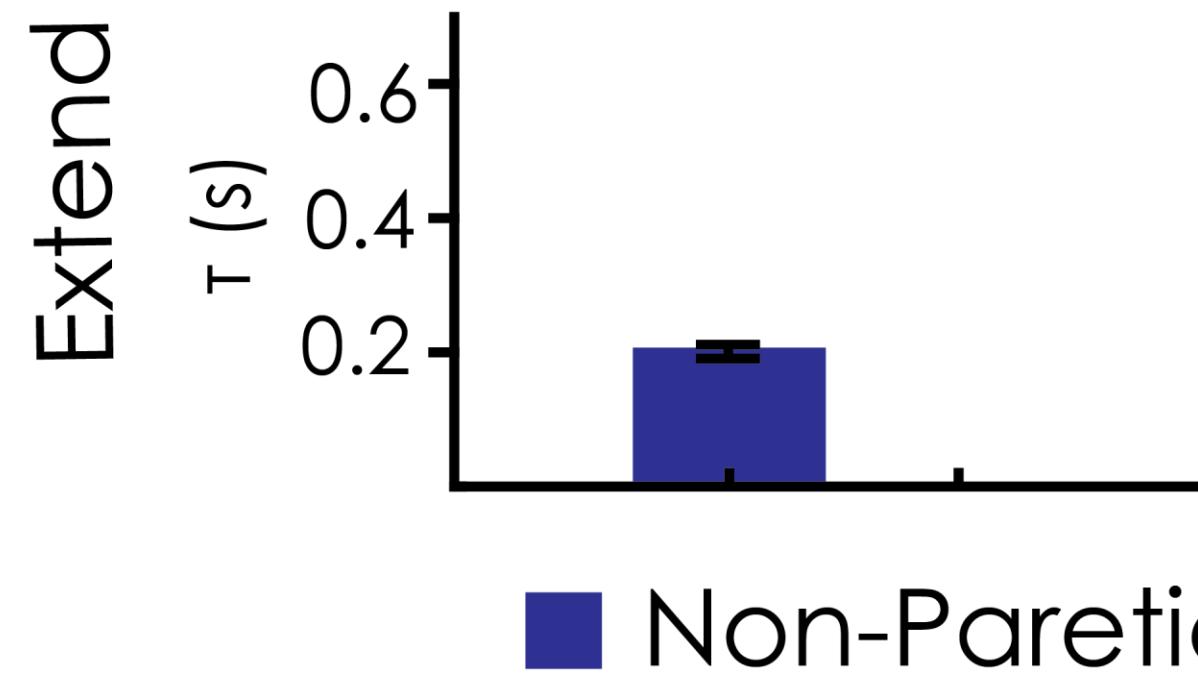


Termination

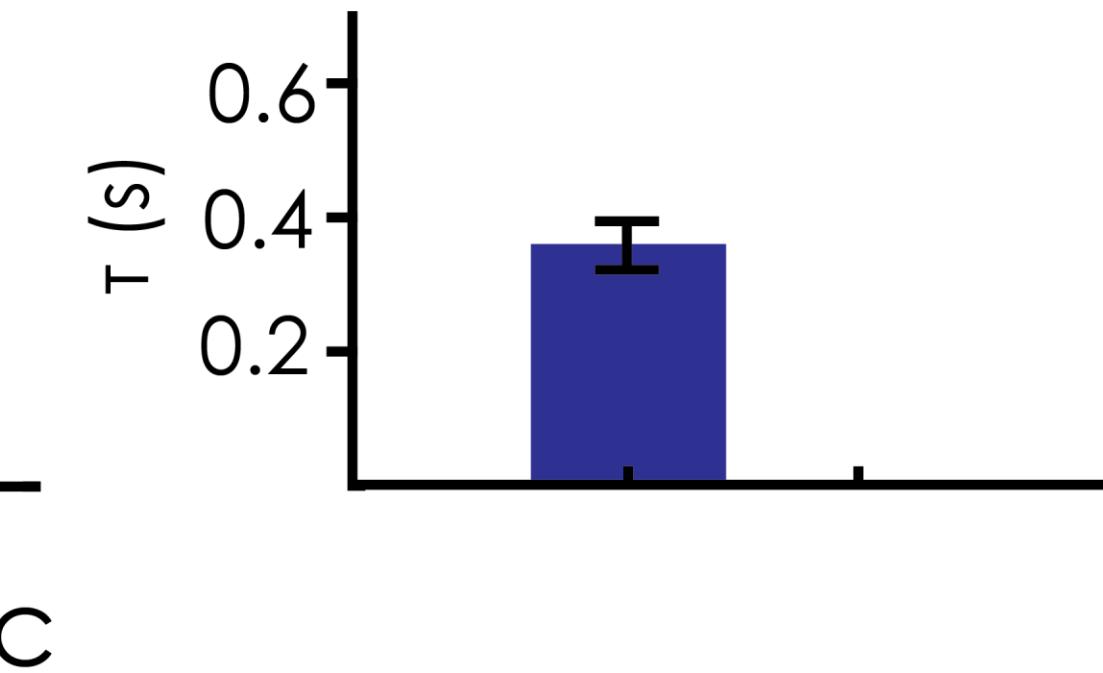


# INCREASED INITIATION AND TERMINATION TIME CONSTANTS OF EXTENSION ON PARETIC SIDE

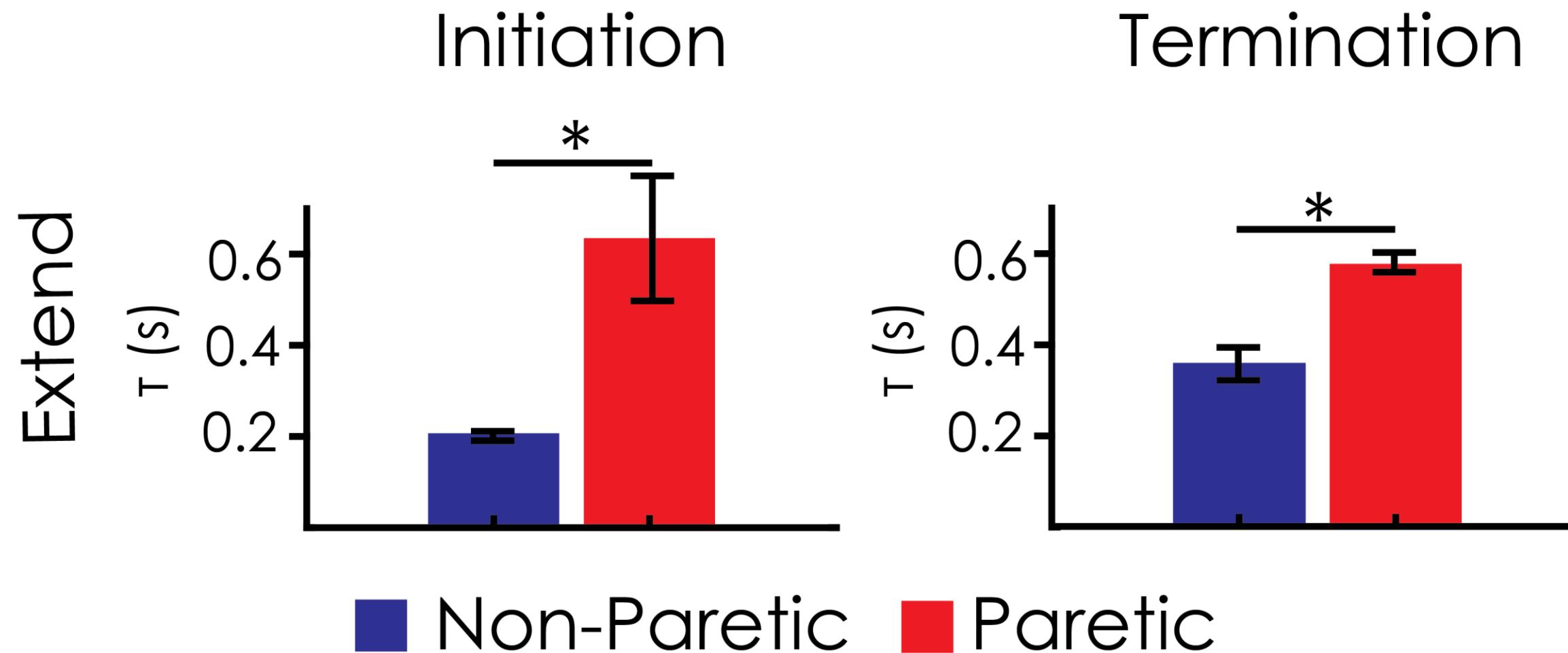
Initiation



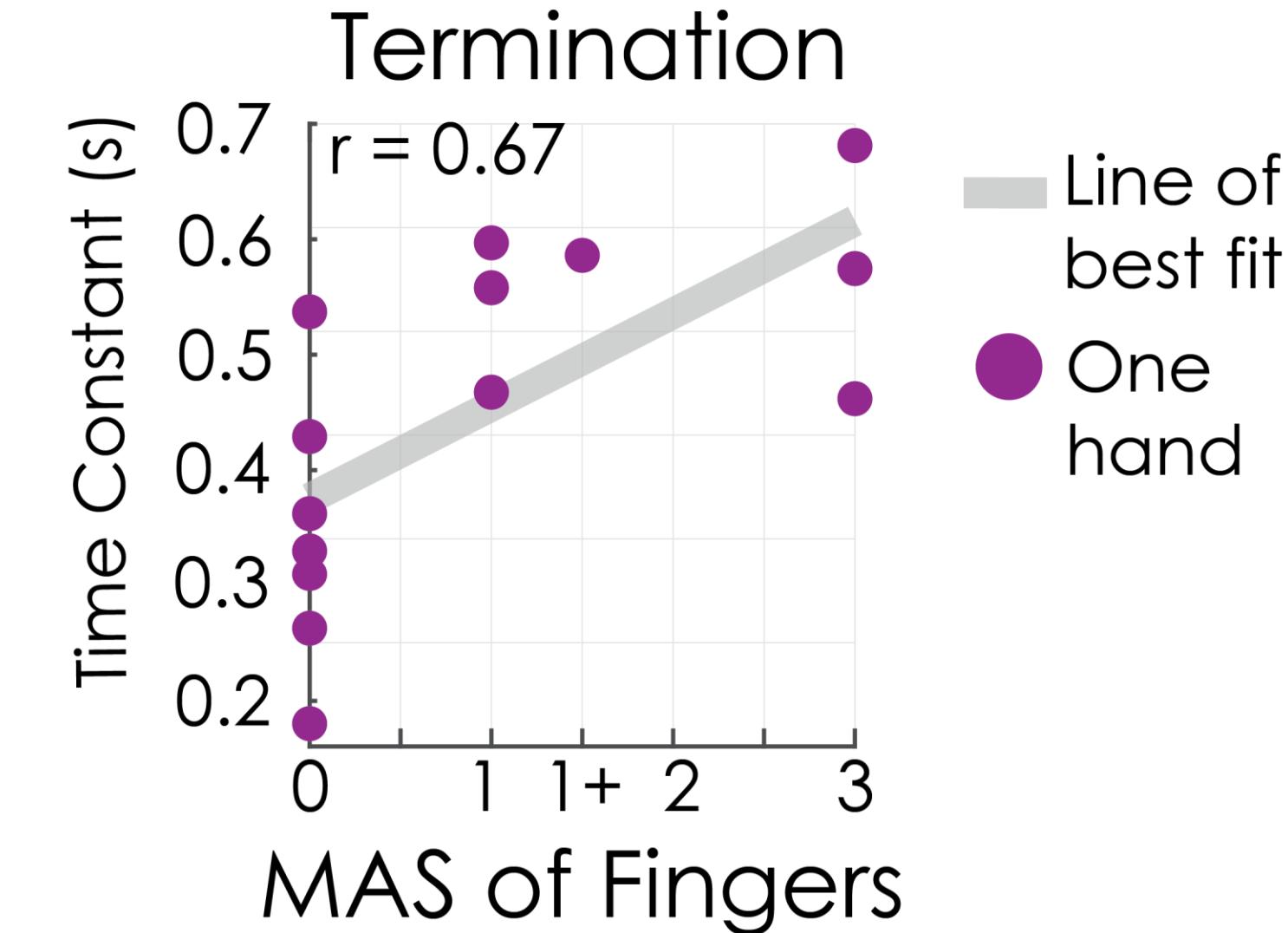
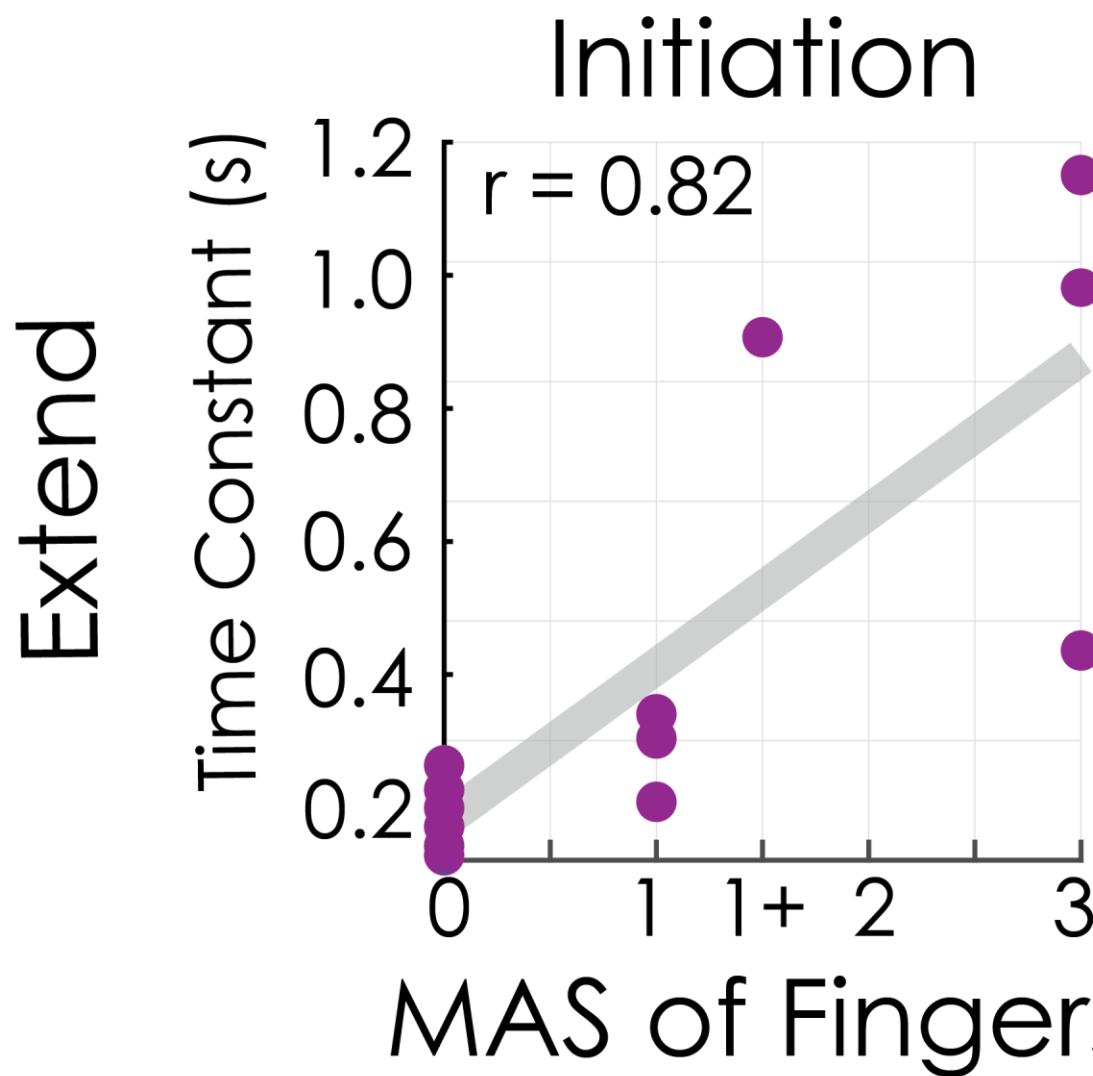
Termination



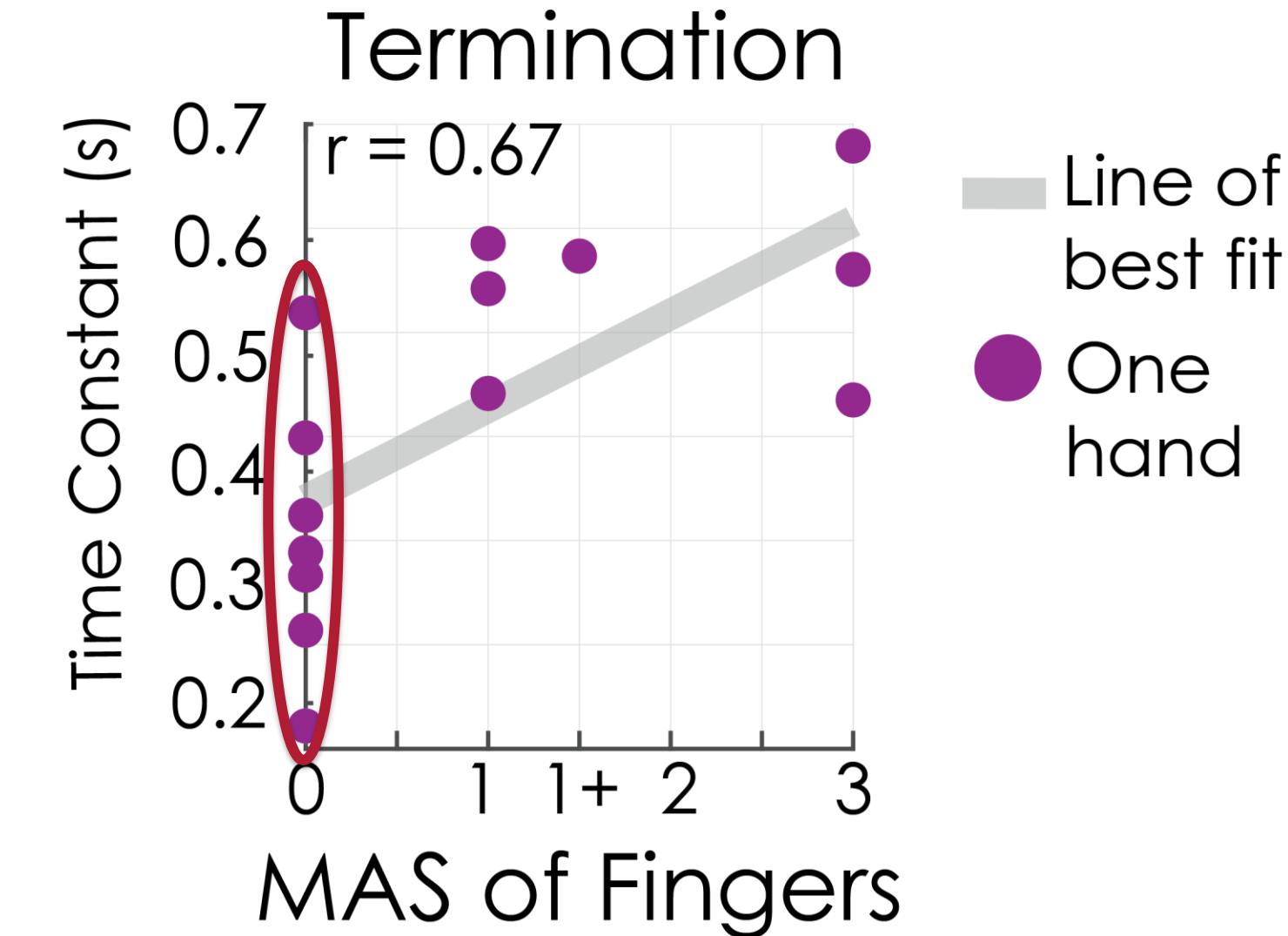
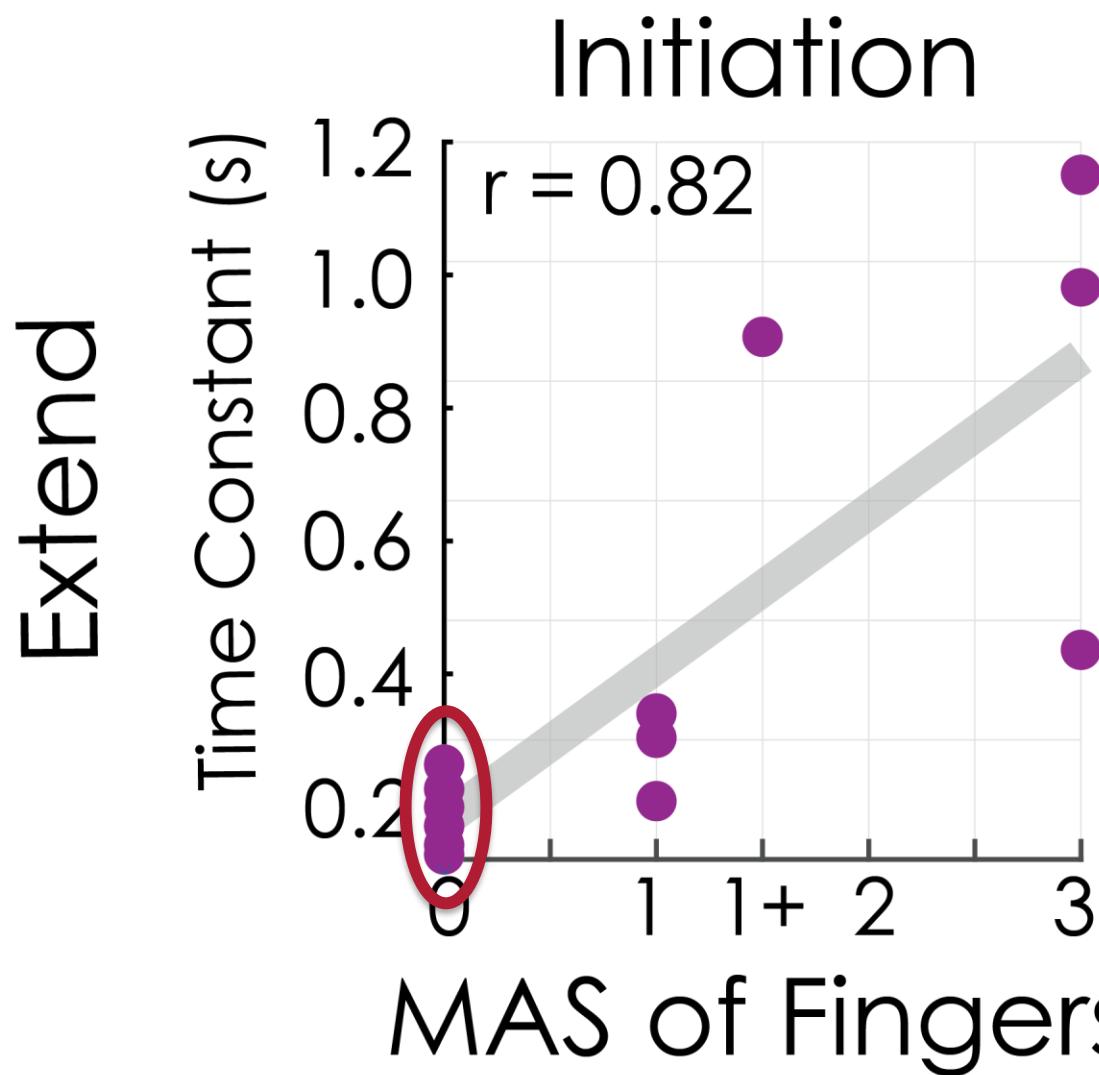
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# PILOT DATA SHOWS CORRELATION BETWEEN EXTENSION TIME CONSTANTS AND MAS SCORE



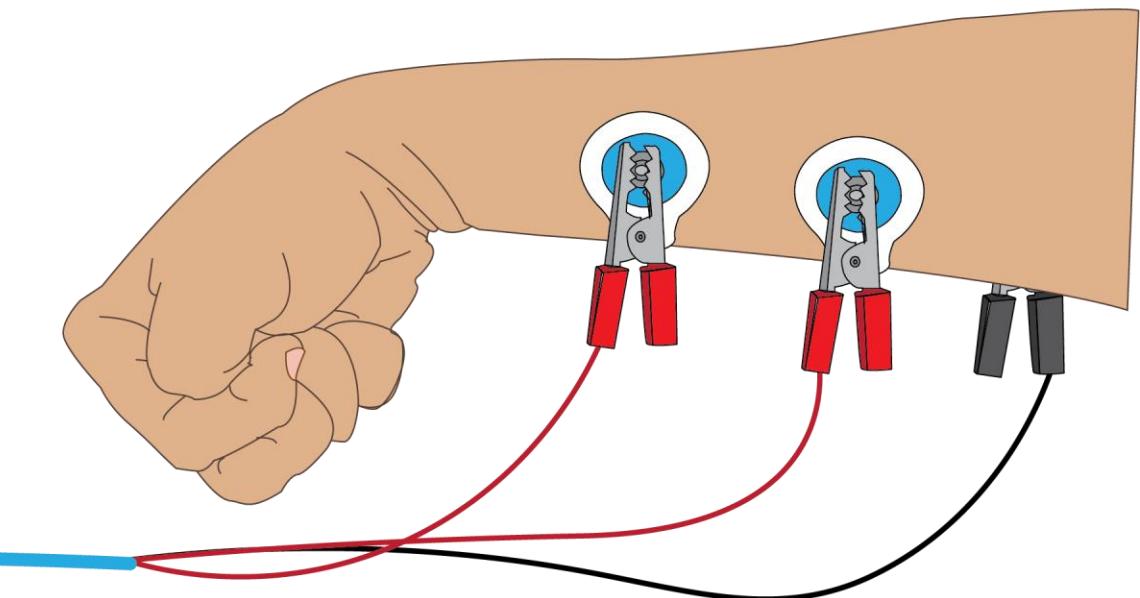
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# CAN PATIENTS CHANGE THEIR TIME CONSTANTS WITH PRACTICE?

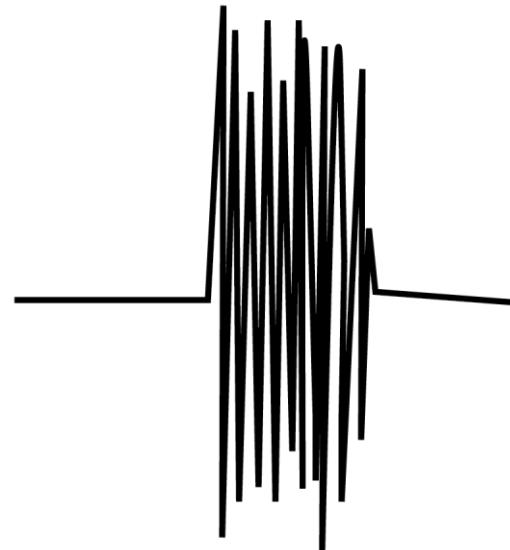


sEMG Biofeedback System



# FUTURE DIRECTIONS

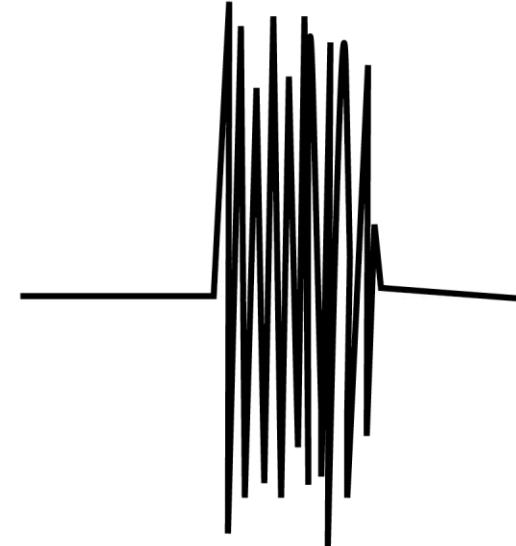
Past and Present



sEMG analysis and  
metric discovery

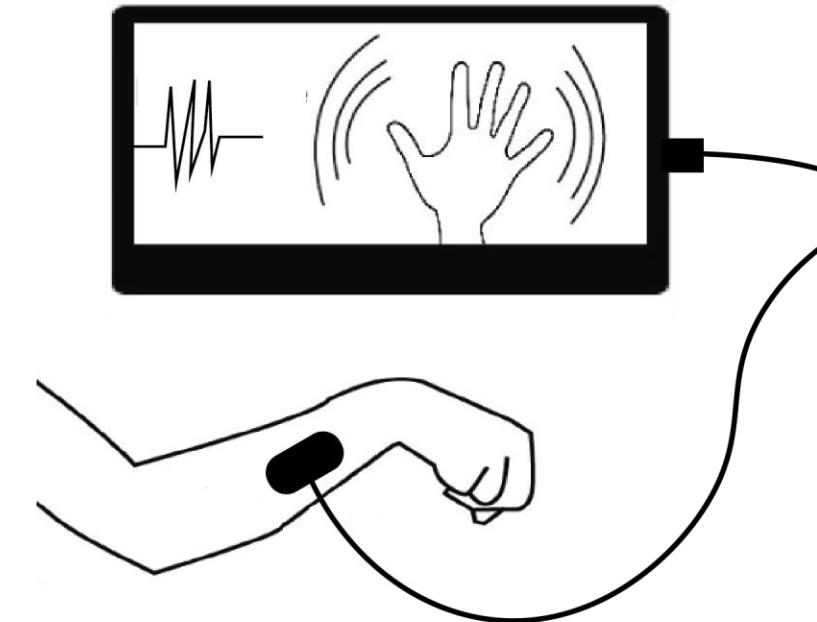
# FUTURE DIRECTIONS

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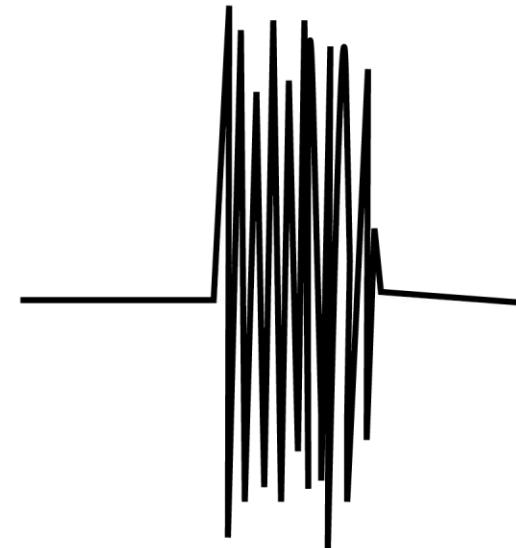
Next Steps



sEMG metric-based,  
portable, low-cost  
biofeedback system

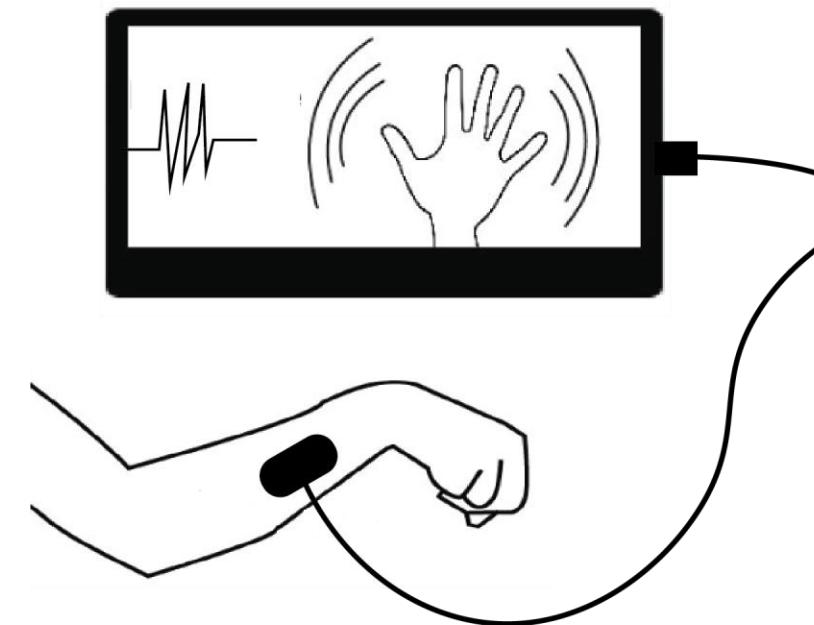
# FUTURE DIRECTIONS

## Past and Present



sEMG analysis and metric discovery

## Next Steps



sEMG metric-based, portable, low-cost biofeedback system

## Long-Term Goal



Incorporate metrics and biofeedback into exoskeletons

# Acknowledgments



## Supervisory Committee

Jacob George, Ph.D.

Lorie Richards, Ph.D.

Karen Wilcox, Ph.D.

Elliot Smith, Ph.D.

Cory Inman, Ph.D.

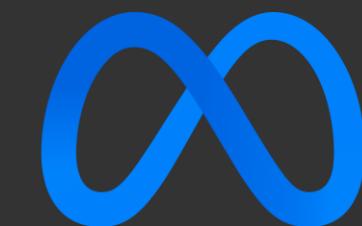
Adrian Rothenfluh, Ph.D.

## Industry Collaborator: Myomo

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OD029571



Meta Reality Labs  
Award #  
2990450277899571



VA Award  
UU-2022-  
SAHAT-01

# REFERENCES

1. Virani SS, Alonso A, Benjamin EJ, et al. Heart Disease and Stroke Statistics—2020 Update: A Report From the American Heart Association. *Circulation*. 2020;141(9):e139-e596. doi:[10.1161/CIR.0000000000000757](https://doi.org/10.1161/CIR.0000000000000757)
2. Lai, S. M., Studenski, S., Duncan, P. W., & Perera, S. (2002). Persisting consequences of stroke measured by the Stroke Impact Scale. *Stroke*, 33(7), 1840–1844. <https://doi.org/10.1161/01.str.000019289.15440.f2>