

# Rectus Tendon Transfer with Diaphragm Pacing to Restore Diaphragm Excursion in Phrenic Neuropathy

Matthew D. Ramsey, MD<sup>1</sup>, Jong Uk Kim, PhD<sup>2</sup>, KwanHo Kim, PhD<sup>2</sup>, John Rogers, PhD<sup>2</sup>, Colin Franz, MD, PhD<sup>3,4</sup>, Sumanas Jordan, MD, PhD<sup>1</sup>

1 Division of Plastic and Reconstructive Surgery, 2 McCormick School of Engineering, 3 Physical Medicine and Rehabilitation, 4 Shirley Ryan Ability Lab, Chicago, IL, 60611



## Background

- PhN impairs diaphragm contraction, often resulting in ventilator dependence and increased mortality from respiratory complications
- 2021 review: chronic ventilation can have mortality rates as high as 51-71.8% in hospital settings and up to 91.8% in home or nursing home settings (1)
- 2012 financial analysis: mechanical ventilation accrued a cost of \$423,596 per one-year survival (2)

## Research Objectives

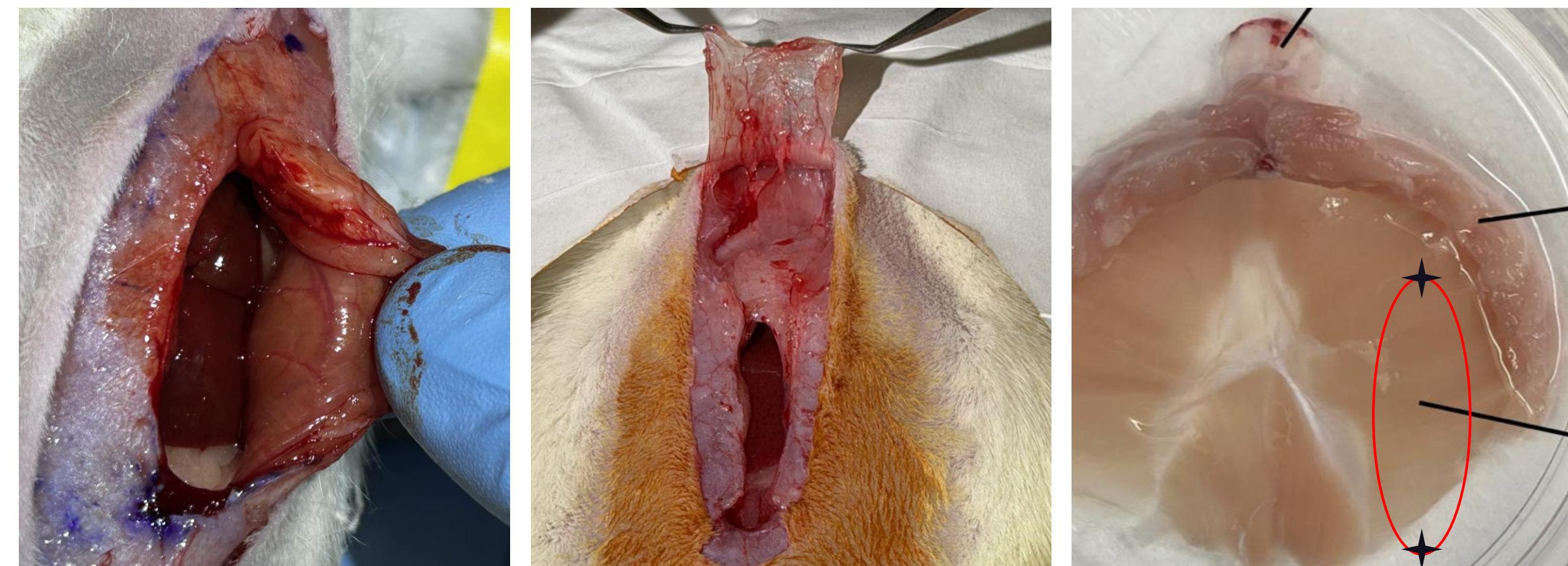
Develop and validate a new functional, pedicled rectus abdominis tendon transfer with dual, synchronized intercostal motor nerve pacing to restore diaphragm excursion.

## Methods

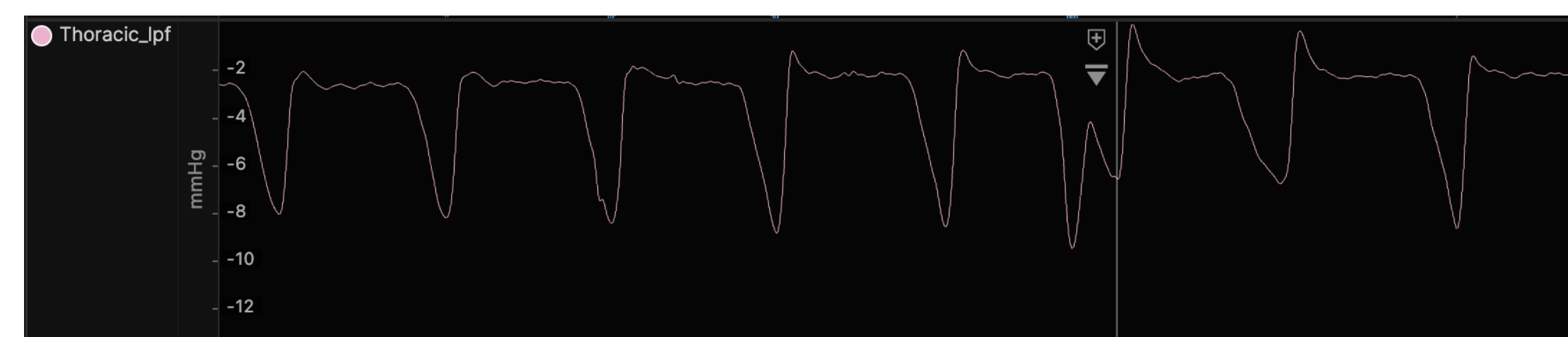
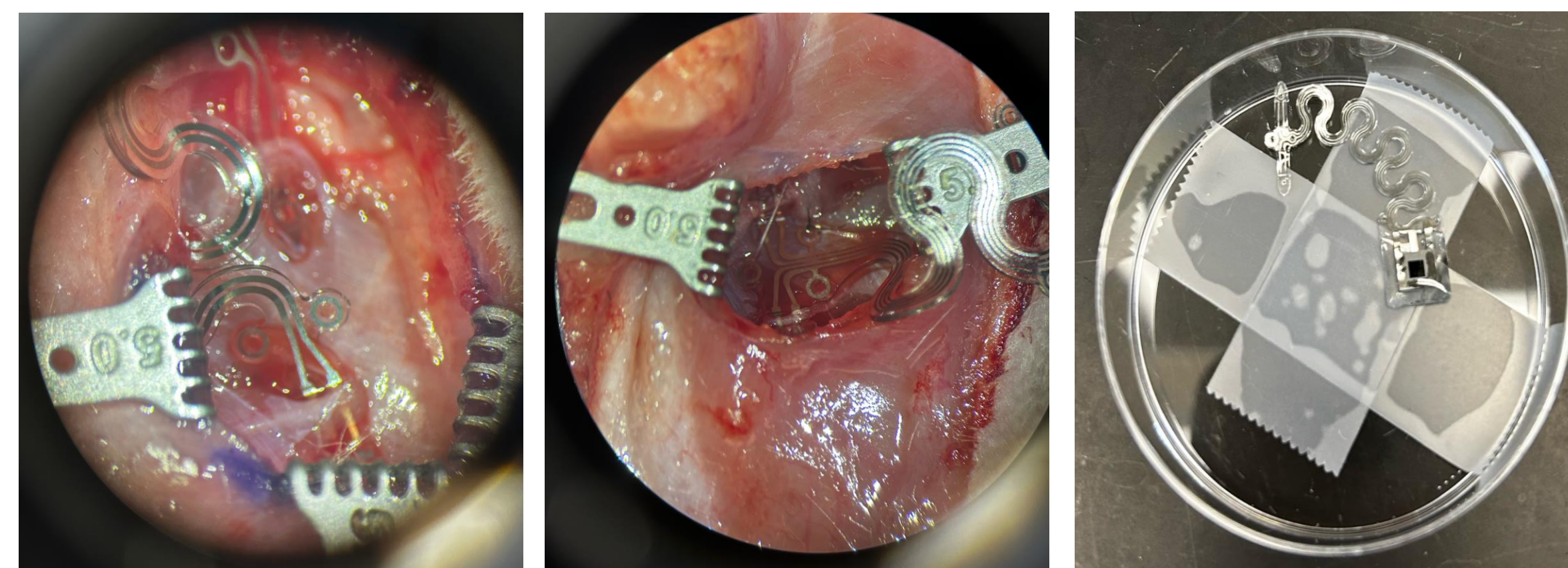
Preclinical rat model:

- Establish surgical validity
- Modify prior pacer with Rogers Research Group
- **Primary Outcome:** Inspiratory pressure change

## Surgical Technique Optimization

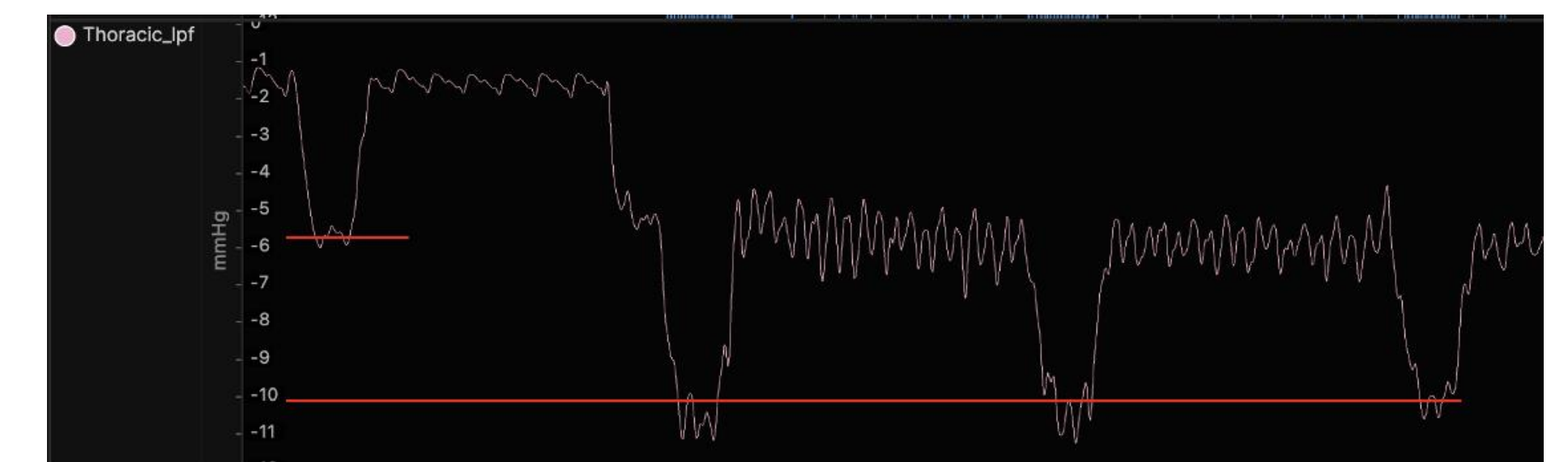


## Technology: Dual Motor Nerve Pacer

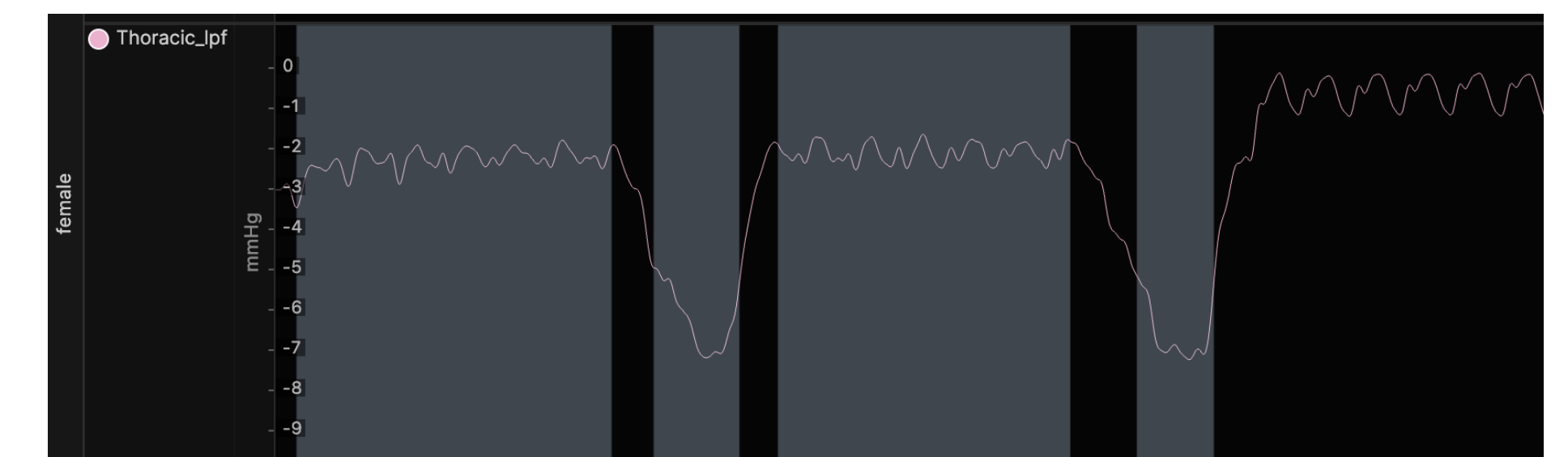


## Results

### Dual Motor Nerve Stimulation



### Single Motor Nerve Stimulation



	Native De...	Stim Delta	Insp Delta		Native De...	Stim Delta	Insp Delta
Dual	mmHg	mmHg	mmHg	Single	mmHg	mmHg	mmHg
	-4.688	-4.281	-4.337		-3.833	-4.304	-1.990

## Conclusion

A unilateral, pedicled, functional rectus abdominis tendon transfer with dual motor nerve stimulation can effectively double the inspiratory pressure gradient under anesthesia.

1. Sison SM, Sivakumar GK, Caufield-Noll C, Greenough WB, 3rd, Oh ES, Galiatsatos P. Mortality outcomes of patients on chronic mechanical ventilation in different care settings: A systematic review. *Heliyon*. Feb 2021;7(2):e06230. doi:10.1016/j.heliyon.2021.e06230  
 2. Criner G. Long-term ventilator-dependent patients: new facilities and new models of care: the American perspective. *Rev Port Pneumol*. Sep-Oct 2012;18(5):214-6. doi:10.1016/j.rppneu.2012.04.004