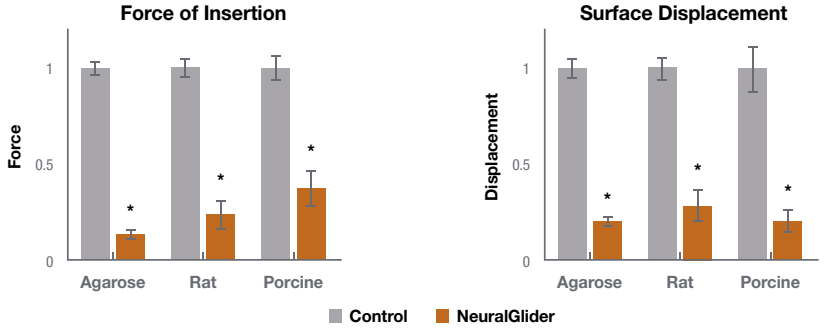
NeuralGlider®

Neural Implant Inserter

Reduces insertion trauma and improves placement accuracy of penetrating neural implants in preclinical studies.

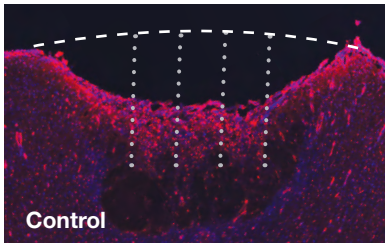
Actuated Medical, Inc. designed the NeuralGlider Inserter to maximize the quality of chronic neural implant recordings in preclinical neuroscience studies. NeuralGlider applies micron-scale, ultrasonic vibration to neural implants during insertion to reduce the force required to penetrate the brain surface. NeuralGlider has been tested in vitro, ex vivo and in vivo with a variety of neural implants. The reduced insertion force facilitates slow (0.1 mm/s), accurate implant insertions while minimizing displacement/dimpling of the cortical surface, preserving the integrity of the underlying neural tissue.

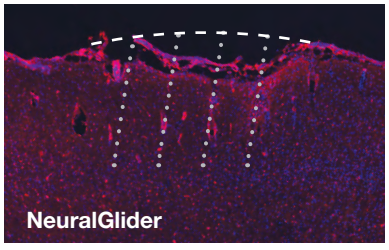


Ultrasonic vibration of microwire arrays during insertions with NeuralGlider significantly reduced penetration force in an agarose brain model, and ex vivo rat and porcine cortex (reductions in force = 86.3%, 76.5% and 62.7%, respectively). The reduction of force correlates to a 70 - 80% reduction in cortical surface displacement/dimple during array insertion, for all tissues. *p< 0.0001; error bars = standard error of the mean. All data were normalized to the non-vibrated/control insertion average for each tissue.

Key Advantages

- *Reduced insertion force and tissue dimpling yielding less insertion damage and neuron loss*
- *Integrated software for control of insertion velocity and depth*
- *Compatible with acute neural recording setup*
- *Improved insertion of neural implants*





Compared to a standard control insertion (left), NeuralGlider reduced cortical surface damage and blood brain barrier leakage (IgG staining, red) at the microwire array insertion site (right). Images showed 20 µm rat cortical sections, 2 weeks after implantation with 2x4, 50 µm microwire arrays.

Compatible with neural implants such as:

Tucker Davis Technologies Microwire Arrays, Microprobes Microelectrode Arrays, NeuroNexus Acute and Chronic Silicon Microelectrodes, NeuroNexus Vector Probe, Plexon U- S- V- Probes, Qualia Probes, Lawrence Livermore National Laboratory Probes, NeuroNexus Matrix Array, Microprobes, Floating Microelectrode Array.

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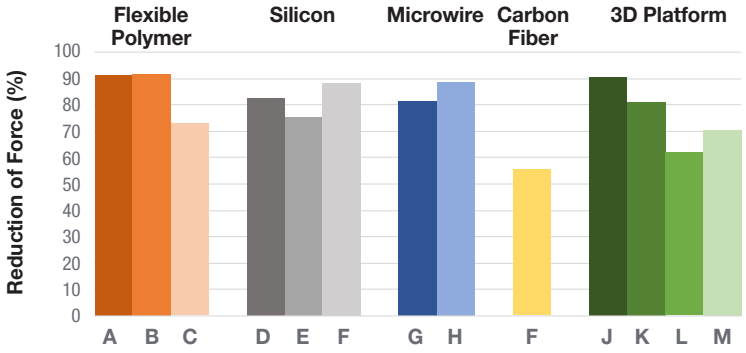
Learn more at NeuralGlider.com

IN VITRO

NeuralGlider vibration greatly reduced required initial insertion force for many available preclinical electrophysiology neural implant designs.

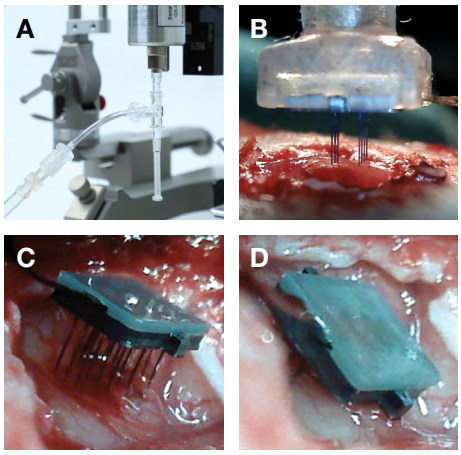


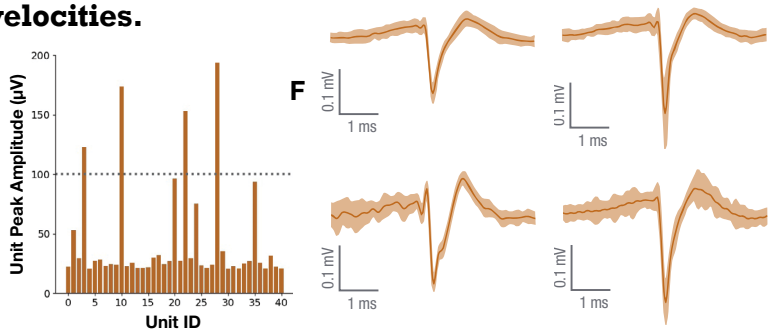
Reduction of force testing performed using agarose bench model (600 µm thick 1.5% pia layer). N = 2-15 insertions/array type. Power = 0.25-3 W (optimized for array type), Insertion velocity = 0.05 mm/s.

- **A** Lawrence Livermore National Laboratory Probe
- **B** University of North Carolina Probe
- **C** Qualia Softening Brain Probe
- **D** NeuroNexus A1x32 Edge A32 Acute Array
- **E** NeuroNexus A4x4 A16 Linear Acute Array
- **F** NeuroNexus A4x4 H16 Linear Chronic Array
- **G** Tucker Davis Technologies Omnetics Based Array
- **H** Tucker Davis Technologies ZIF-Clip Based Array
- **I** Multimodal Integrated Neural Technologies High Density Carbon Fiber Array
- **J** NeuroNexus Matrix Array™
- **K** Plexon and Modular Bionics N-Form® Array
- **L** Microprobes Floating Microelectrode Array
- **M** Blackrock 10 x 10 Utah Array™ (modified)

IN VIVO

NeuralGlider vibration allows NeuroNexus Matrix Arrays to be fully inserted at slow velocities.



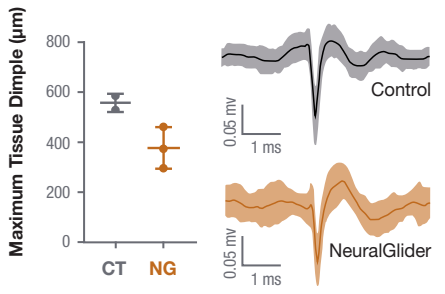


(A-B) NeuralGlider Coupler transmits vibration while using vacuum pressure to secure the neural implant during insertion. **(C)** Control and **(D)** NeuralGlider insertions into in vivo brain model. Insertions performed at velocity = 0.05 mm/s. Note complete penetration of Neural-Glider array.

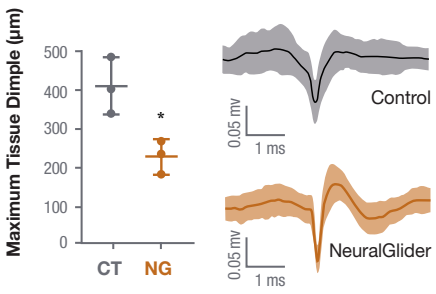
Spontaneous multi-unit neural activity (MUA) was recorded over a period of 15 min following a 45 min post-insertion recovery period. **(E)** Action potential waveforms were clustered using a spike sorting algorithm and waveforms corresponding to single neurons (N = 41) were isolated from MUA recordings. **(F)** Spike waveform templates with action potential amplitudes exceeding 100 µV (dashed line E) were selected and each template was compared to underlying action potential waveforms to validate automated sorting process.

NeuralGlider vibration allows for Reduction in Maximum Tissue Dimple.

Microprobes Floating Microelectrode Array



NeuroNexus H-Series Array



Dimpling reduction was detected while inserting Microprobes 16-shank Floating Microelectrode Arrays (p=0.07) and NeuroNexus 4-shank H-Series arrays (p=0.02) 1-1.25 mm into barrel cortex. Recording performance was comparable for NeuralGlider and non-vibrated (control) array insertions. N= 2-3/treatment; Gray = Control (CT), Orange = NeuralGlider (NG) insertions, Bars = Means ± Std. Deviations. *p<0.05.

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