Utah array

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The Utah array is widely used in both clinical studies and neuroscience. It has a strong track record of safety. However, it is also known that implanted electrodes promote the formation of scar tissue in the immediate vicinity of the electrodes, which may negatively impact the ability to record neural waveforms. This scarring response has been primarily studied in rodents, which may have a very different response than primate brains.

Patel et al. present a rare nonhuman primate histological dataset (n=1 rhesus macaque) obtained 848 and 590 days after implantation in two brain hemispheres. For 2 of 4 arrays that remained within the cortex, NeuN was used to stain for neuron somata at 3 different depths along the shanks. Images were filtered and denoised, with neurons then counted in the vicinity of the arrays as well as a nearby section of control tissue. Additionally, 3 of 4 arrays were imaged with a scanning electrode microscope (SEM) to evaluate any material damage that might be present.

Main results: Overall, we found a 63% percent reduction in the number of neurons surrounding the electrode shanks compared to control areas. In terms of materials, the arrays remained largely intact with metal and Parylene C present, though tip breakage and cracks were observed on many electrodes.

Significance: Overall, these results suggest that the tissue response in the nonhuman primate brain shows similar neuron loss to previous studies using rodents. Electrode improvements, for example using smaller or softer probes, may therefore substantially improve the tissue response and potentially improve the neuronal recording yield in primate cortex [1].

[1]
Patel PR, Welle EJ, Letner JG, Shen H, Bullard AJ, Caldwell CM, Vega-Medina A, Richie JM, Thayer HE, Patil PG, Cai D, Chestek CA. Utah array characterization and histological analysis of a multi-year implant in non-human primate motor and sensory cortices. J Neural Eng. 2022 Dec 14. doi: 10.1088/1741-2552/acab86. Epub ahead of print. PMID: 36595323.

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