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Electromyogram recordings for internal capsule stimulations in non-human primates

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ABSTRACT

EMG recordings is a common method to confirm implant location. In this protocol, we describe steps to perform EMG recordings during an internal capsule stimulator implant surgery. This procedure maybe performed in both sterile and non-sterile surgeries, but here we only describe the steps for a non-sterile, terminal experiment setup.

For step by step guidelines to plan an internal capsule implant surgery with the clinical robot, ROSA ONE Brain, refer to this protocol:
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We use this protocol and it's working

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MATERIALS

- Needle EMG electrodes (7mm & 13mm)
  RLSND107-2.5 & RLSND110-2.5, Rhythmlink, Columbia, SC
- Ripple Neuro Grapevine or any equivalent recording system with 6+ input channels
  Ripple Neuro Trellis software
  Blue touchproof Microbox
  High-voltage protected headstage
- High Power Isolated Stimulator (AM Systems Model 2100)
- Disposable bipolar stimulation probe
- 3M Vetbond tissue glue
- Surgical stapler
- Tape
- Scalpel

BEFORE START INSTRUCTIONS

The animal should be under propofol/fentanyl i.v. (or any other anesthetics that allows for synaptic transmission) anesthesia before any step of this protocol is performed. Consult your veterinarian for details.

This protocols describes only the EMG procedure and assumes there is already an electrode placed within the hand area of the internal capsule of the animal.

Needle electrode implants

1 Make a small incision on the forearm **opposite** to the side of the internal capsule (IC) electrode implant.

2 Locate the flexor carpi radialis and/or any other muscle of interest, stimulate at around 1mA, 1Hz with bipolar probe electrode to confirm muscle.

3 Place two 13mm needle electrodes inside, but along the belly of the muscle for differential EMG recording.

4 Apply a few drops of Vetbond tissue glue to help the needles stay in place.

5 Close the incision with staples and tape the electrode cables to the arm. This will prevent them from being pulled out by accident.

6 Repeat for upper arm, hand, and face muscles, or any other muscles of interest. Incision and stapling are not necessary for face muscles.

IC stimulation & EMG recording

7 Stimulate the IC at 1Hz or 2Hz with continuous and biphasic pulses, and in the range of 0.8-4.8mA, depending on the motor threshold of the animal.

8 If no movement was observed during stimulation, adjust the depth of the IC electrode slightly (+/- 2mm) to get a better activation.

9 Once movement is observed, bring the stimulation amplitude down to motor threshold, record EMG with Ripple Neuro Trellis (or equivalent, at at least 2k samples per second).

10 Check that the EMG activation is localized to the hand muscles.