Essential surgeries for the electrophysiological recording from a behaving non-human primate brain 2 (Craniotomy)

Robert S
Daisuke Kase[1], Witold J Lipski[1], Devin R Harsch[1], Turner[1]

[1]Department of Neurobiology, University of Pittsburgh

Daisuke Kase
Department of Neurobiology, University of Pittsburgh

DEC 05, 2023

OPEN ACCESS

DOI:
dx.doi.org/10.17504/protocols.io.n92ldmz48l5b/v1

Protocol Citation: Daisuke Kase, Witold J Lipski, Devin R Harsch, Robert S Turner 2023. Essential surgeries for the electrophysiological recording from a behaving non-human primate brain 2 (Craniotomy). **protocols.io** https://dx.doi.org/10.17504/protocols.io.n92ldmz48l5b/v1

Protocol status: Working
We use this protocol and it's working

ABSTRACT

Outlined below are the steps to complete a craniotomy in an existing recording chamber placed on a cranial implant. This procedure can be done concurrently with the implant surgery (not recommended), or can take place upon recovery from the implant surgery.

MATERIALS

	Item	Specifications	Vendor	Note
	Drill bit	40 Gauge	McMaster-Carr	https://www.mcmaster.com/3584A225/
	Pin vise		McMaster-Carr	https://www.mcmaster.com/8455A31/
	Bone rongeur	Jaw width: 1.3mm Length: 5.5"	Roboz	http://shopping.roboz.com/micro-scissors-micro-forceps-groups/Rongeurs/Micro-Friedman-Rongeur-5-5-Very-Delicate-Curved

Created: Aug 01, 2023

Last Modified: Dec 05, 2023

PROTOCOL integer ID: 85783

Keywords: ASAPCRN, Non-human primate, Craniotomy, Electrophysiology

Funders Acknowledgement:
Aligning Science Across Parkinson's through the Michael J. Fox Foundation for Parkinson's Research (MJFF)
Grant ID: ASAP-020519
NIH
Grant ID: R01 NS093164
NIH
Grant ID: R01 NS070865
NIH
Grant ID: R01 NS091853
NIH
Grant ID: R01 NS117058

	Item	Specifications	Vendor	Note
	Kerrison bone punches	Jaw width: 4mm Jaw position: 90 deg.	Aesculap	https://www.aesculapusa.com/en/healthcare-professionals/or-solutions/or-solutions-neurosurgical-instruments/kairison-pneumatic-bone-punch.html
	Excavator spoon	#1 and #153-154	Nordent instruments	https://nordent.com/product/excavator-1-2/ https://nordent.com/product/excavator-english-pattern-153-154-2/
	Gelfoam	12-7 mm	Pfizer	https://www.pfizermedicalinformation.com/en-us/gelfoam-absorbable-gelatin-powder
	HemaBlock		HemaBlock	https://hemablock.com/

List of key materials for the craniotomy surgery

Note: Bone punches with larger jaw width (5mm or 6mm) works well to expand the craniotomy

Preparation in the prep room on the day of surgery

1 Sedate the animal.

2 Intubate the animal, start the gas anesthesia, and bring it to the surgical suite.

Note

The intubation should be performed by a skilled veterinarian or technician.

Procedure in the surgical suite

3 Secure the animal's head on the stereotaxic frame.

4 Open the recording chamber.

5 Clean the surface of the implants (chamber, head fixation post, dental acrylic, etc.) with Betadine and ethanol.

6 Scrub in for the surgery. Wash hands (5 min per hand) and don a surgical gown and sterile gloves.

7 Cover the animal's whole body with a sterile drape.

8 Put a sterile drill bit in the pin vise, and expose the drill bit about 3-4 mm from the pin vise.

Note

You may remove some dental acrylic with dental drill if there is a thick layer of dental acrylic inside the chamber.

9 Slowly drill the first hole in the chamber with a pin vise until the pin vice touches the skull. The drill

should not pierce the skull if the length is appropriately adjusted.

> **Note**
>
> Irrigate the skull and drill bit with sterile saline during this process.

10 Extend the drill bit a small amount, approximately 0.5 mm, then return to the hole that you drilled.

11 Deepen the hole.

> **Note**
>
> Continue to irrigate the skull and drill bit with sterile saline during this process.

12 Move to the next step if the skull is pierced and you can see the surface of the dura (it will look like a fascia of a piece of chicken). If the skull has not been pierced yet, return to Step 10.

13 Make many holes to draw a circle of holes in the recording chamber.

14 Remove the bone between holes with the bone rongeur.

> **Note**
>
> The excavator spoon is also useful for removing the skull in a narrow space.

15 If bones between all holes are entirely removed, there should be a circle-shaped bone in the middle of the recording chamber.

16 Raise the circle-shaped bone with tweezers and/or excavator spoon slowly and carefully.

Note

Do NOT push the circle-shaped bone that you have cut out down onto the dura. Be careful to ensure that no lever is created that will push onto the dura.

17 Remove the circle-shaped bone with tweezers carefully.

18 Expand the hole with the bone punches.

Note

1: Shave the edge of the hole with an excavator spoon to expand the hole if the hole is not large enough to insert the lower jaw of the bone punches.

2: Ensure there is no sharp bone piece in the hole when inserting the lower jaw of the bone punches into the space between the dura and skull.

19 Scrape the sharp edge of the skull with the excavator spoon.

Note

Bone punches cannot make a completely smooth, round shaped hole. If there is any sharp edge on the hole, such edges may push the dura and potentially cause the leak of the CSF in the future.

20 Rinse the small pieces of bone from the chamber with saline.

21 Measure the distance from the top edge of the chamber to the surface of the dura in multiple locations inside the chamber (ex. most medial, lateral, anterior, posterior corners, and center of the chamber).

22 Place the chamber's cap onto the chamber and secure it.

23 Stop the gas anesthesia, remove the intubation when the animal starts showing the reflex Then, return the animal to the home cage.