



A Method for Electrophysiological Evaluation of Peripheral Facial Nerve in Rats

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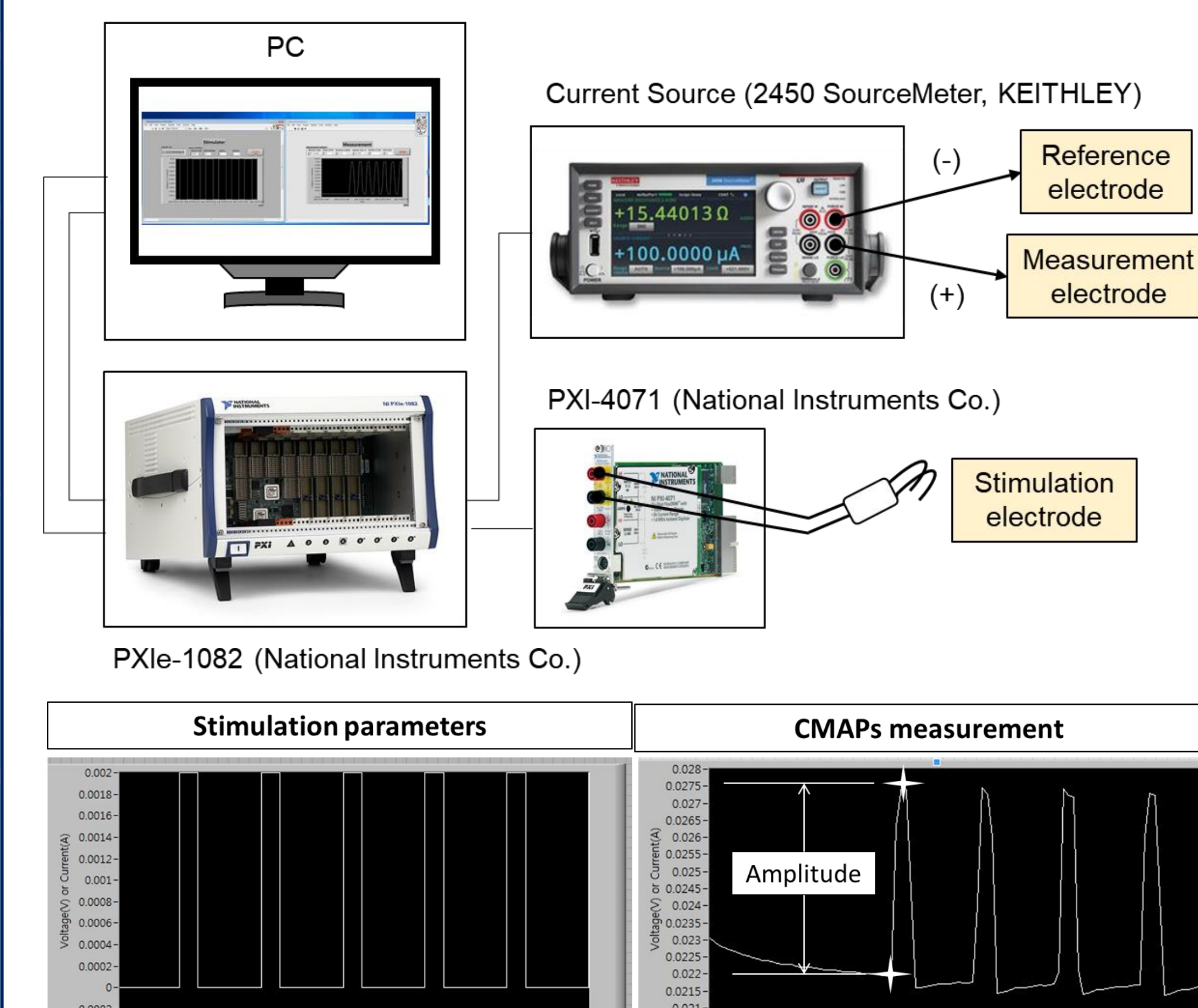


BACKGROUND

Compound muscle action potential (CMAP) recording via regenerated motor nerves is a critical examination to evaluate functional outcome of nerve regeneration. However, there is not much documentation on the detailed method of CMAP recording via the peripheral facial nerve (FN). Here we introduce our new CMAP recording procedure and CMAP was recorded from vibrissa muscles of Sprague Dawley (SD) rats after electrical stimulation of facial nerve.

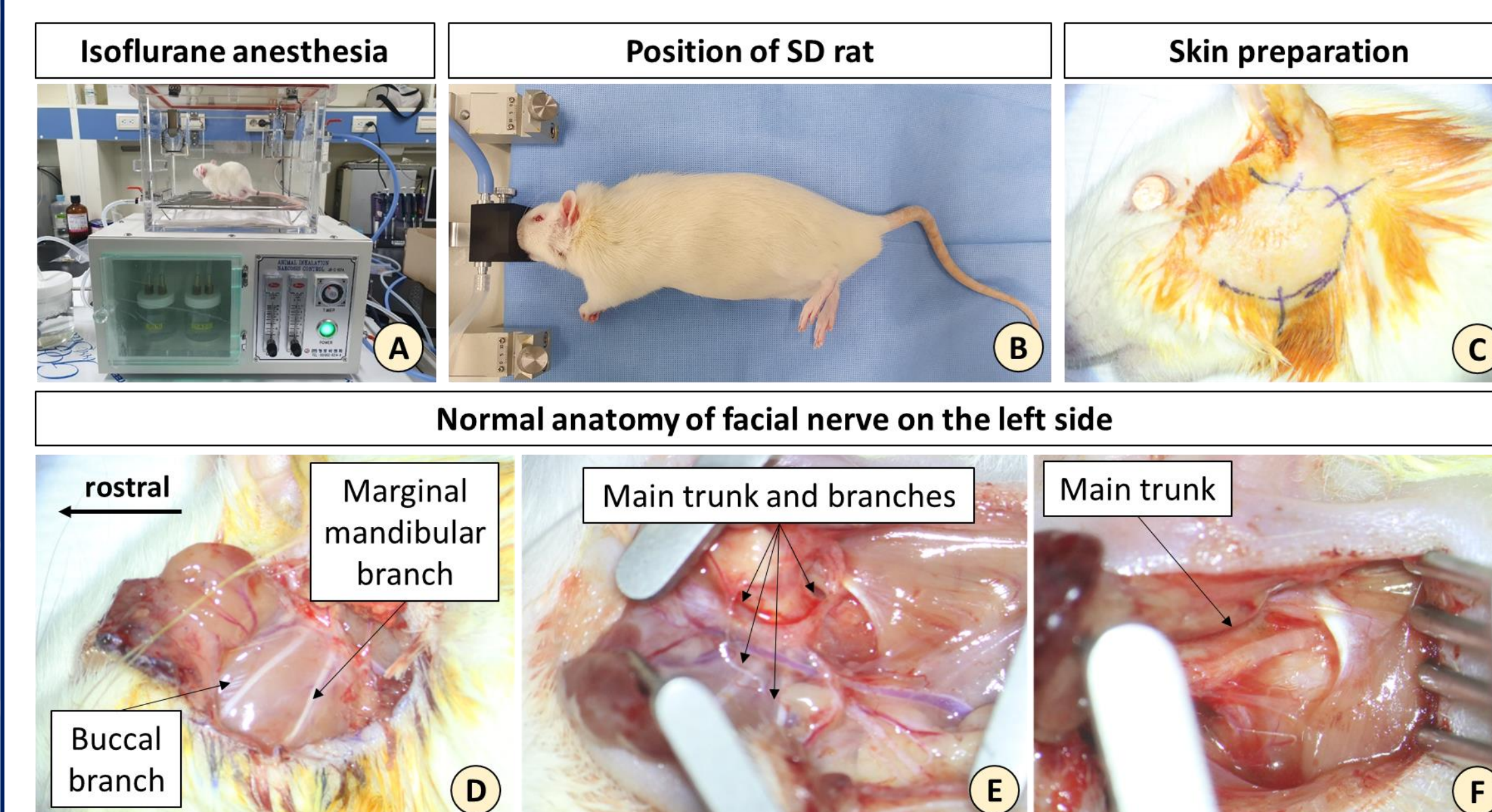
METHODS

Figure 1. System block diagram



→ Intensity: 0.5-2.0 mA, duration: 1 s, latency: 4 s

Figure 2. Experimental setup

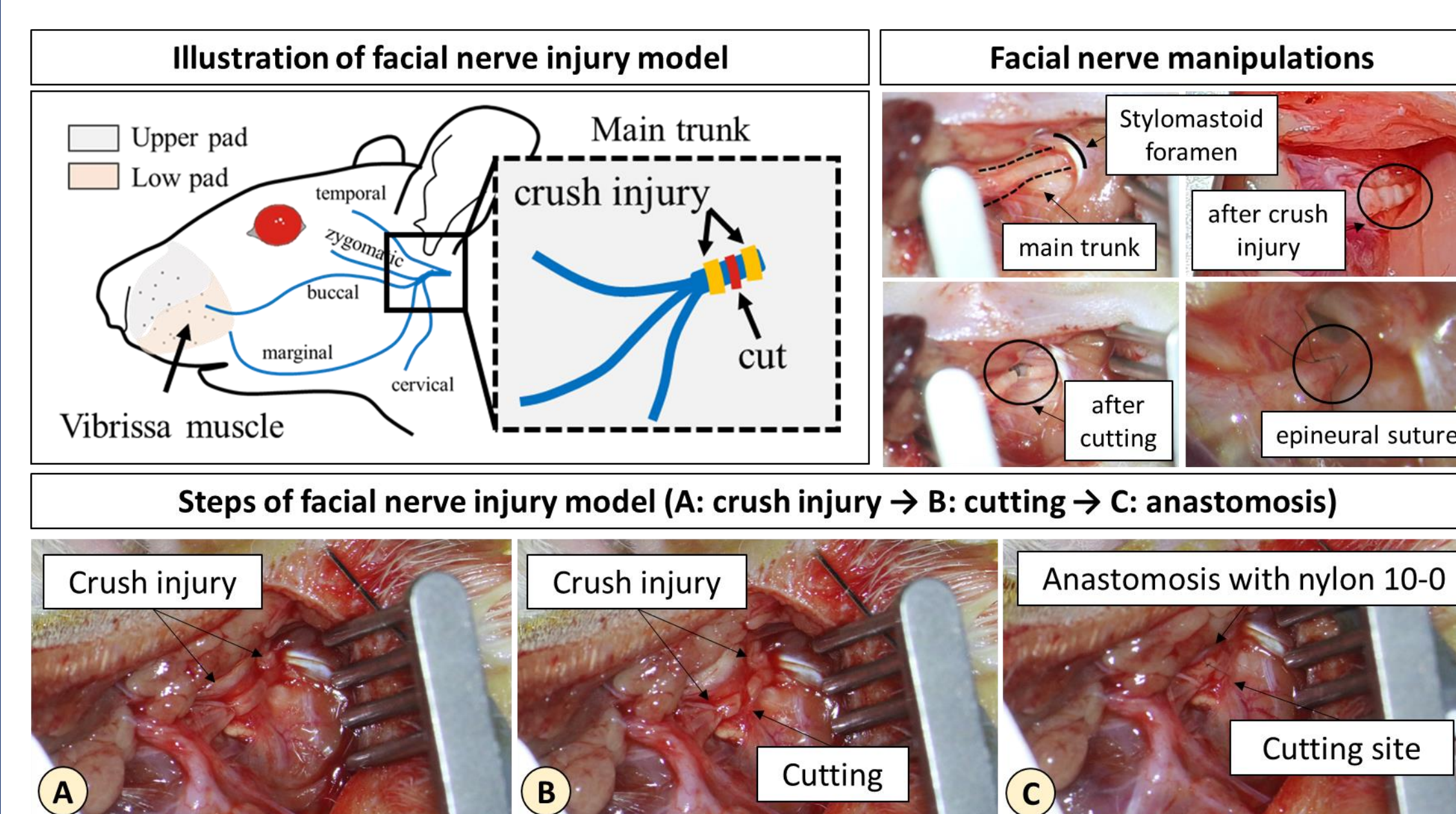


After isoflurane anesthesia (A), the SD rat (6Ws, male) laid down with the left side facing up (B). A left pre-auricular incision was made (C). The main trunk and branches of the left facial nerve were exposed (D-F).

Figure 3. How to run the CMAP recording system

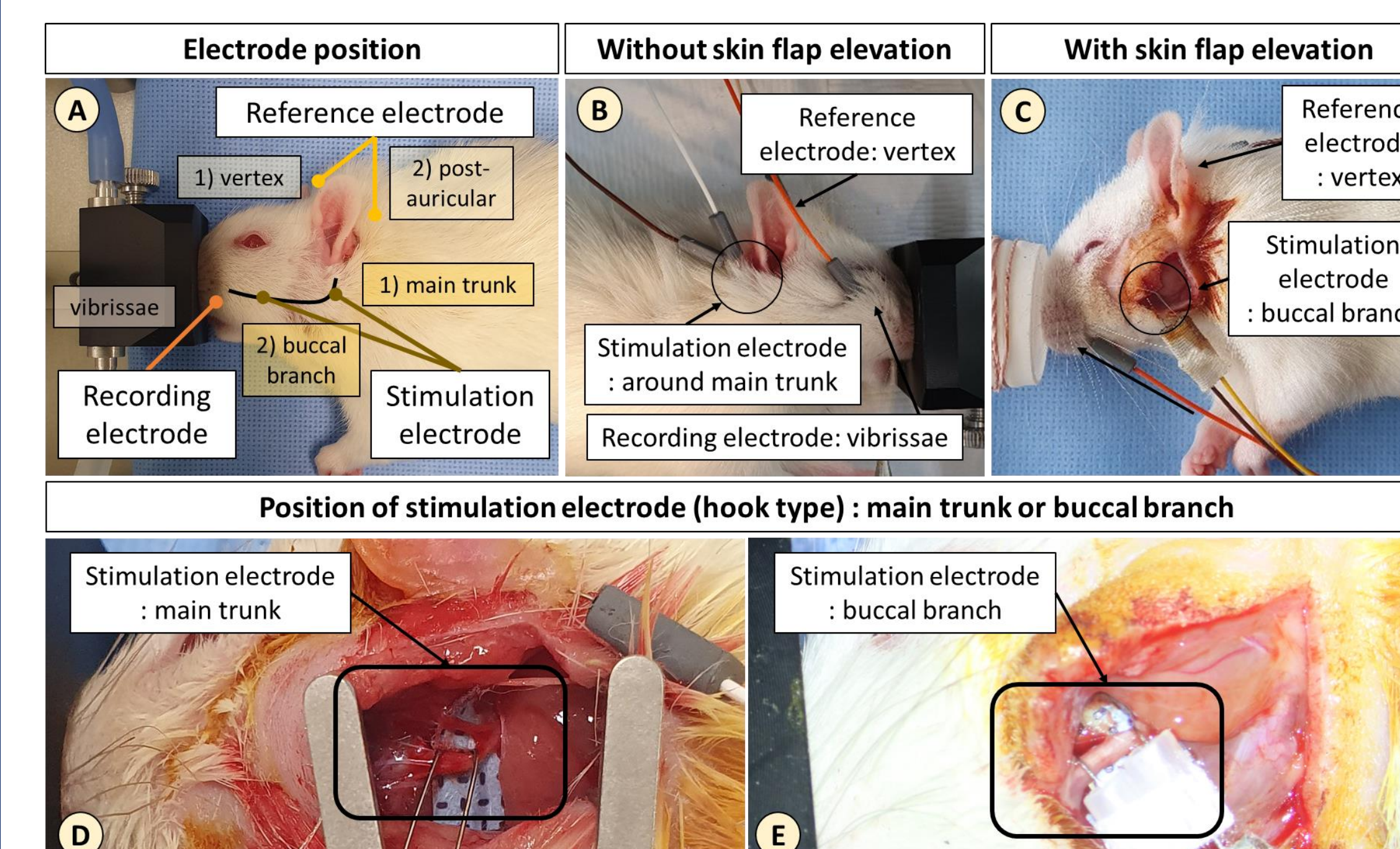


Figure 4. Facial nerve injury model



The main trunk of the left facial nerve was double-crushed just distal to the stylomastoid foramen as presented above (A). After then, the main trunk was cut between crushed nerve (B) and repaired with one or two 10-0 nylon epineurial sutures (C).

Figure 5. The position of electrode



CMAPs from the vibrissal muscles were recorded after rats were laid down with the left or right side facing up (A). A needle type reference electrode was inserted into the vertex (B) or post-auricular area (C). The recording electrode placed into lower portion of vibrissal muscles. The two stimulation electrodes placed main trunk of facial nerve (D) or buccal branch (E).

RESULTS

Figure 6. With/without skin flap elevation



When stimulated the facial nerve without elevated skin flap, twitching around the right ear was observed (A). When stimulated the facial nerve with elevated skin flap, twitching around the left vibrissal muscles was observed (B).

Figure 7. The waveforms of CMAP recording of vibrissal muscles according to position of reference electrode

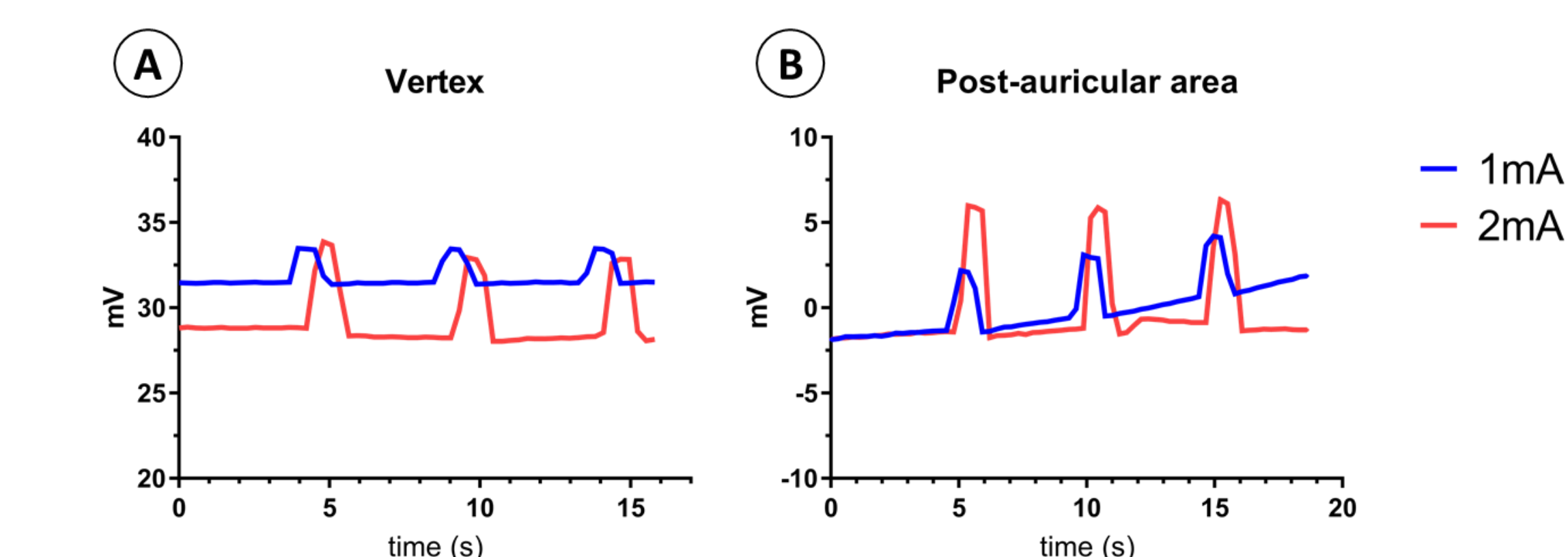
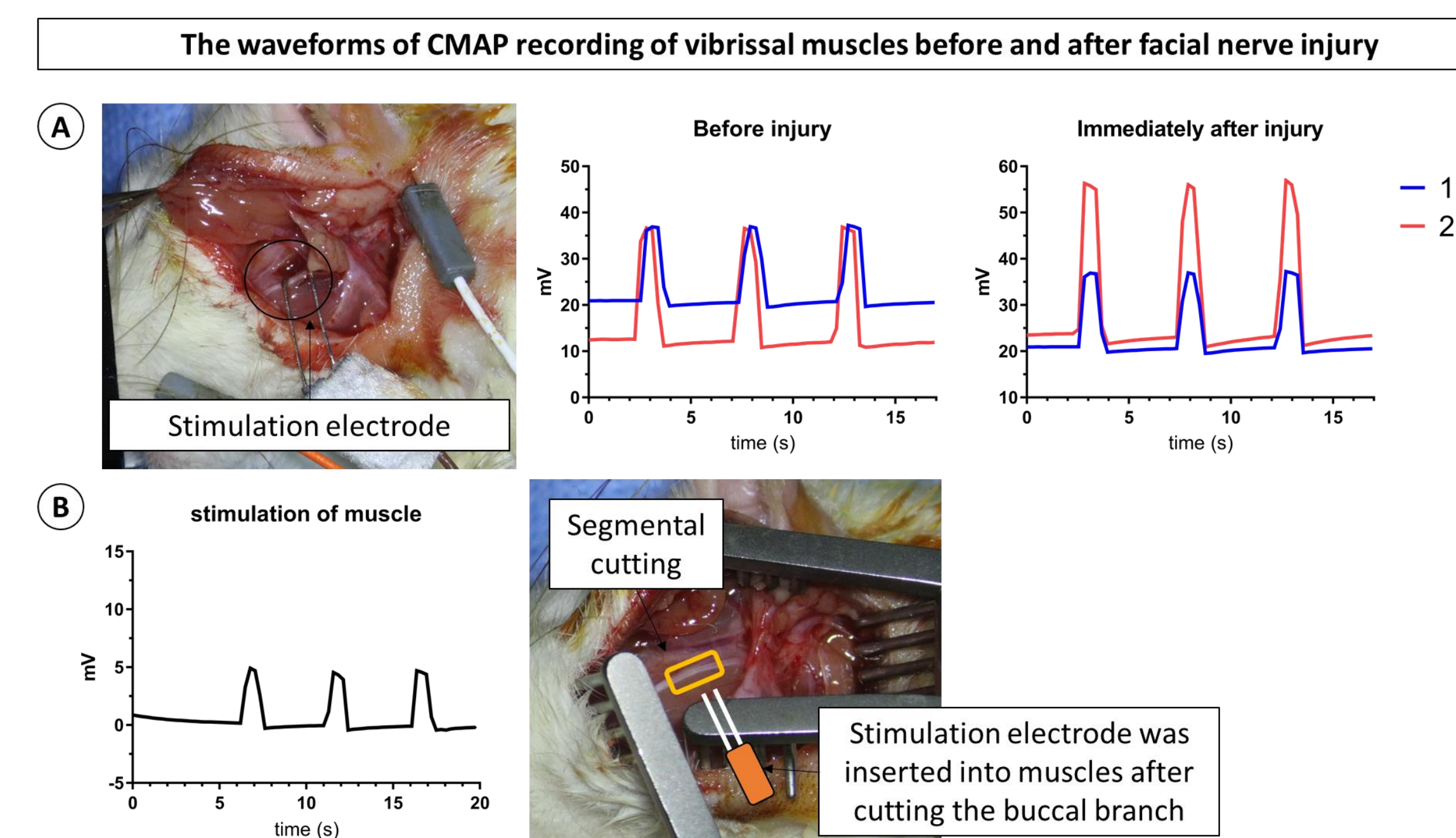
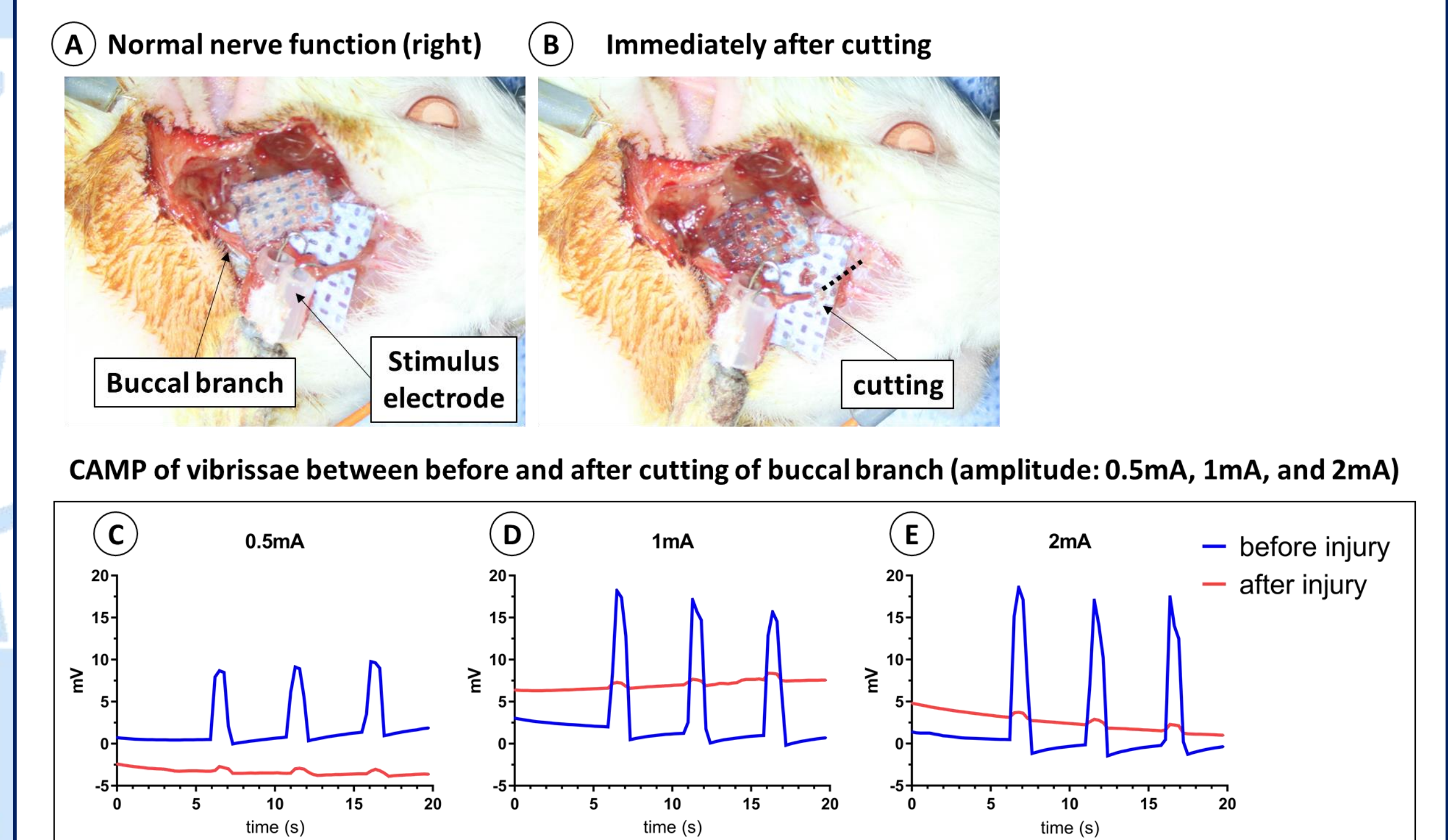


Figure 8. The electric current spread



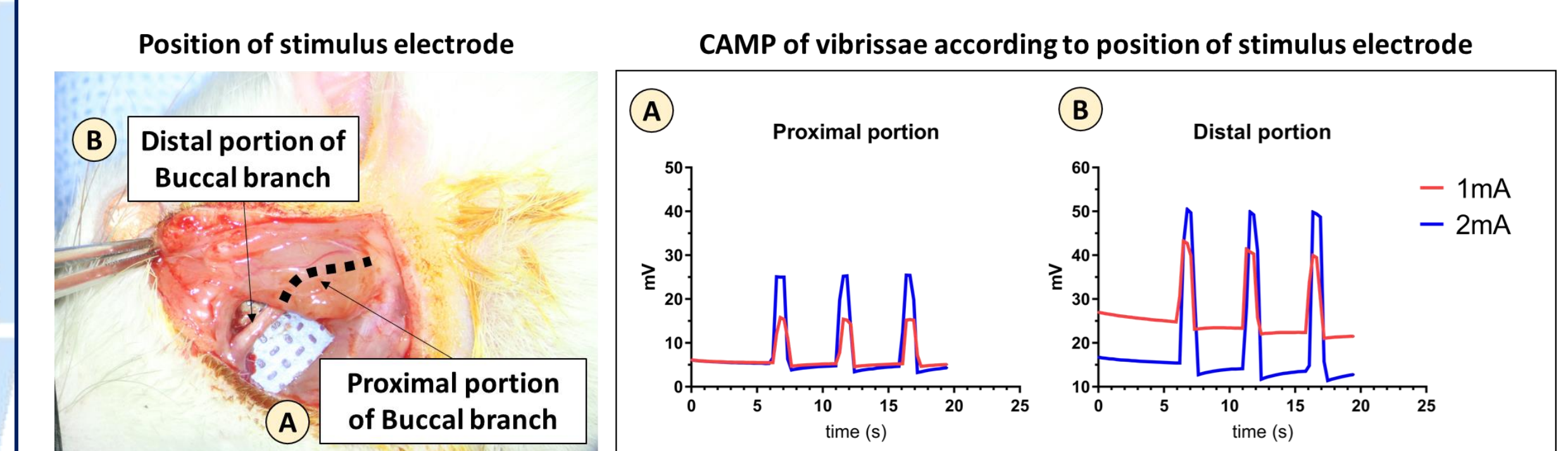
The electric current flow from the stimulating electrode could spreads through the tissue even after facial nerve injury (A). When stimulated the muscle, small waveforms of CMAP recording of vibrissal muscles was observed (B).

Figure 9. The amplitude before and after FN injury



When preventing the current spread, the amplitude of CMAPs recording of vibrissal muscles were decreased after cutting the distal portion of buccal branch.

Figure 10. The amplitude according to location of stimulation electrode



The amplitude of CMAP recording from vibrissal muscles were influenced by the position of stimulus electrode.

SUMMARY

- As the stimulus intensity increased, the amplitude of CMAP increased.
- The amplitude varied depending on the position of the stimulation electrode. Thus, consistent position of stimulation and skin flap elevation would be needed.
- Because electric current flow can be spread throughout muscles, additional insulator surrounding stimulation electrode may be needed.

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