



Radiofrequency Rhizotomy

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Rethi first developed the technique of radiofrequency lesioning in 1913, but it was not until 1975 when Sweet pioneered the method of thermocoagulating the trigeminal nerve rootlets for pain relief.

This technique requires the patient to be awake and cooperative because active feedback is required to map the nerve root and lesion the desired division. Refinements in surgical instruments, including finer cordotomy electrodes and real-time temperature monitors and thermocouples, have improved the safety, selectivity, and efficacy of this procedure. Introduction of a curved-tipped electrode has also further facilitated selective lesioning.

For indications, limitations, and outcomes of different percutaneous procedures, please refer to the chapter on [General Considerations and Indications](#).



TEW Kit Components

- TEW-CN, Cannula;
- TEW-SS, Solid Stylet;
- TEW-STC, Straight TC Electrode;
- TEW-CTC, Curved TC Electrode;
- TEW-IT, Insertion Tool;
- TEW-FA, Flushing Adaptor;
- TEW-DS, Depth Stop;
- CB112-TC, TC Cable;
- TEW-CASE, Case for storage and sterilization.

TEW-R Kit Components

Figure 1: The TEW trigeminal neuralgia kit (Cosman Medical, Burlington, MA) is commercially available. The most important components are shown above.

Operative Procedure

Please refer to the chapter on [Placement of the Needle/Cannula](#)

[within the Foramen Ovale](#) for more details regarding cannulation of the foramen.



Figure 2: Setup of the operating room with the generator in the background. The monitor for the fluoroscope faces the surgeon.

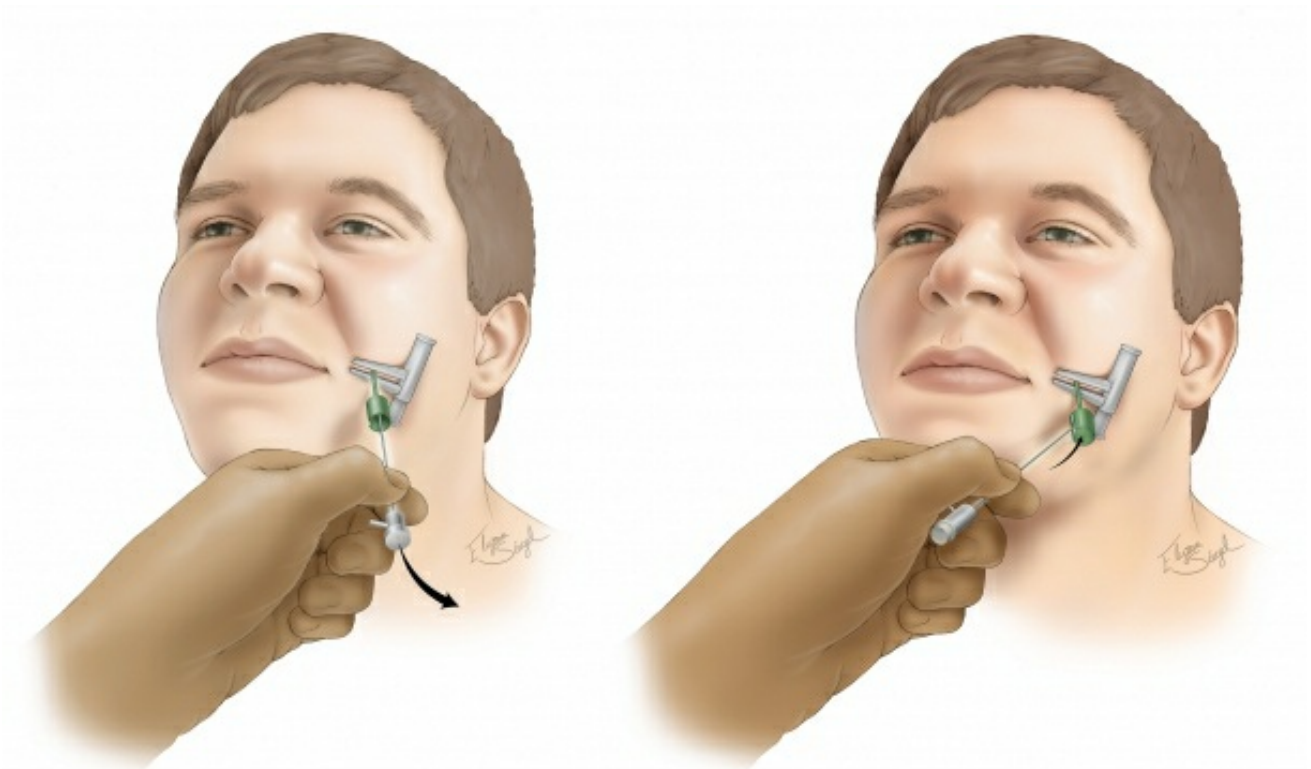


Figure 3: Once placement of the needle cannula within the

foramen is confirmed using fluoroscopy, the proximal end of the cannula is secured at the skin using the depth stop to prevent displacement of the cannula. The obturator/stylet is then removed (left image) and the curved electrode is inserted into the cannula. The curve of the needle is pointed medially. I routinely use only the curved electrode. Note how the curved electrode's tip is guided into the cannula to avoid damage to its tip (right image).

The curved electrode tip is a coil spring and carries a thermocouple, a stimulator, and a lesion-generating probe into the tissue at the tip of the electrode.

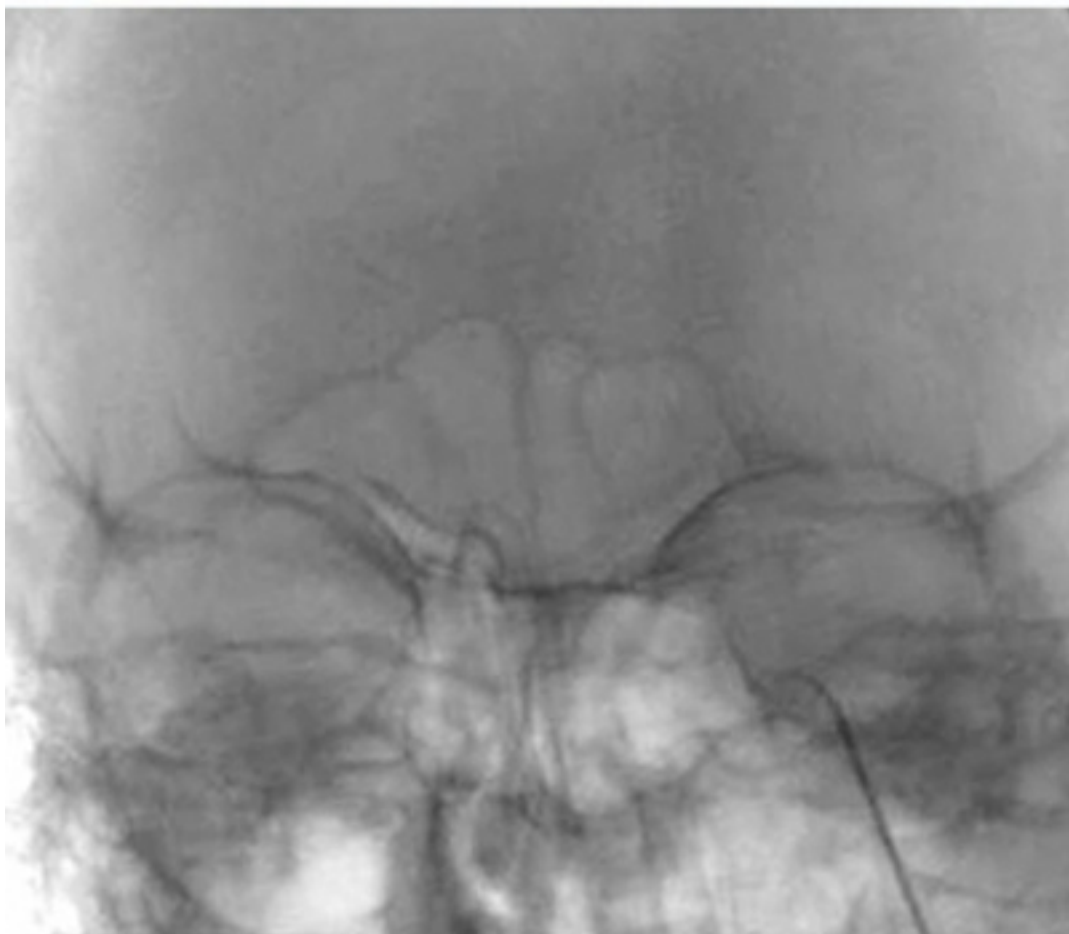


Figure 4: A modified anterior-posterior transorbital image (top image) provides another perspective for ensuring an

appropriate final location for the electrode tip. The angle of the fluoroscope's beam is adjusted until the petrous ridge is positioned radiographically within the mid-portion of the orbit. The curved electrode is directed to the medial porus trigeminus with its tip at the edge of the petrous ridge (bottom image).

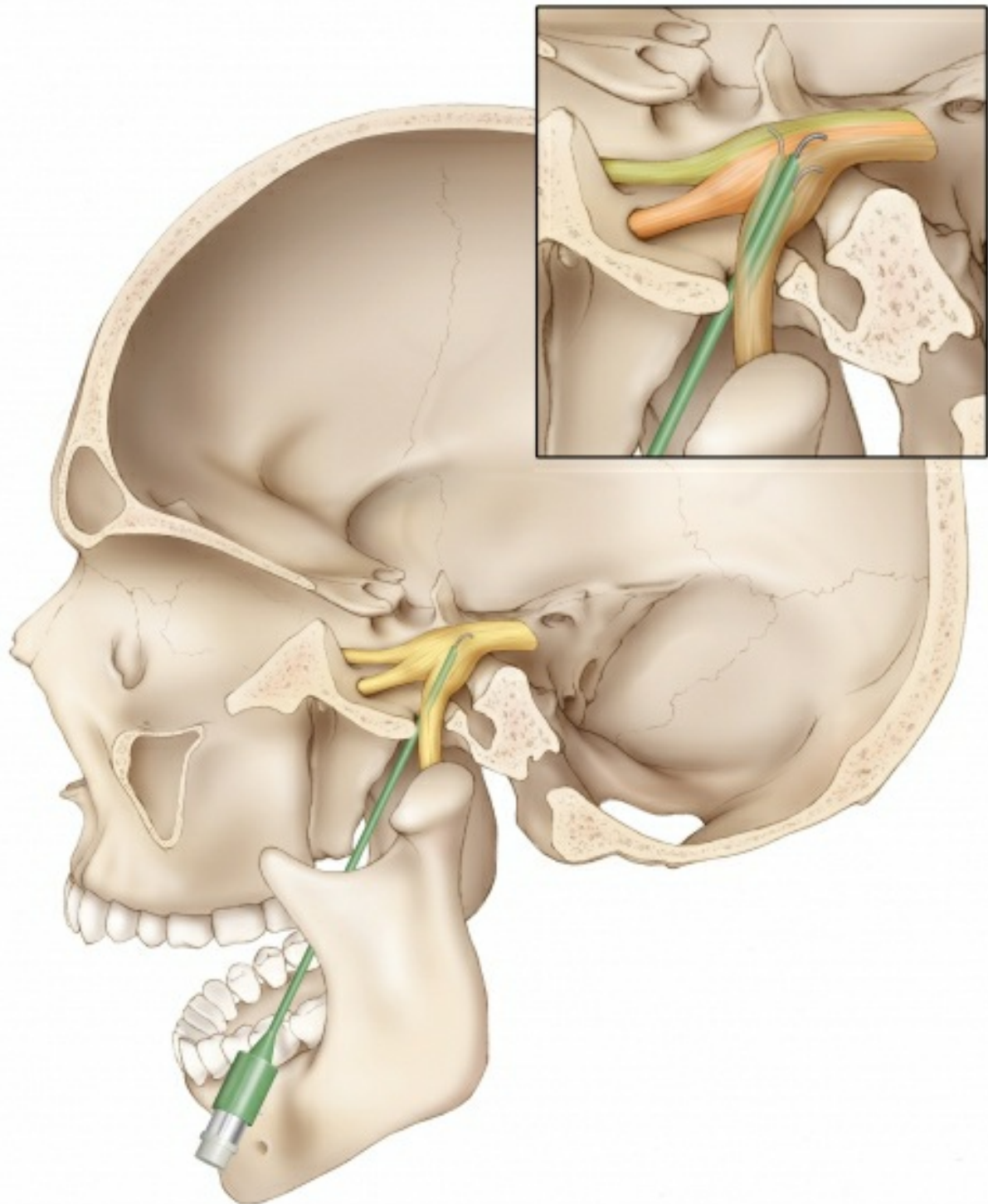


Figure 5: The electrode tip will extend beyond the cannula's tip by 5-10 mm. The electrode depth determines which divisions of the nerve will be contacted. Cranial nerve (CN) V3 will be contacted if the electrode is positioned 5 mm proximal to the clivus. Cranial nerve V2 is contacted when the electrode is at the clivus, and CN V1 when the electrode is 5 mm distal to the clivus. However, the electrode should never extend 10 mm beyond the clivus as CN's IV or VI would be at risk.

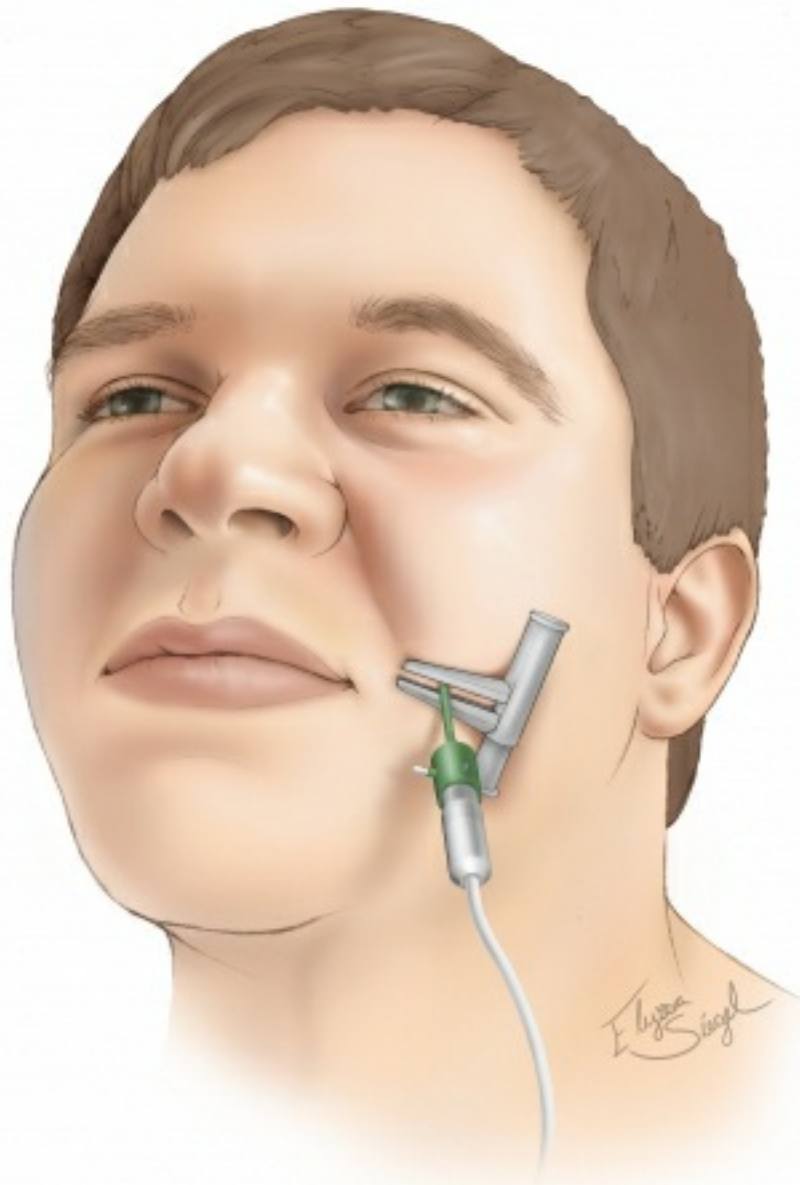


Figure 6: Once the electrode is inserted to the desired depth and

connected to the coaxial cable of the radiofrequency generator, the patient is awakened and his or her sensory and motor responses are tested. Stimulation is used for two purposes:

1) to localize the division responsible for pain generation and potentially reproduce the patient's preoperative pain pattern, thereby ensuring that the electrode is contacting the appropriate nerve fibers, and

2) to determine the intensity threshold required to stimulate the pain. This information guides the duration and temperature required to generate an effective sensory lesion.

The specific details of operation for the generator can be obtained from the operator's manual. I initiate stimulation of pain at the lowest possible settings. Settings of 0.1-0.5 volts (V), 50 PPS (Hz) rate, and 1 millisecond (mS) duration are recommended. Voltage is gradually increased until paresthesias are noted in the same distribution as the patient's preoperative pain.

The voltage may be further increased until the patient's pain is reproduced and the stimulation threshold is noted. This threshold can provide temperature and duration parameters for lesioning. Higher stimulation voltage (0.5-1.5) may be required for those who have undergone previous rhizotomy procedures.

If paresthesia or pain is not provoked in the desired distribution using low intensity stimulation, the cannula should be advanced a few millimeters and the electrode reinserted and stimulation repeated. A curved electrode is superior to a straight electrode because rotation of the electrode 180 degrees caudally allows preferential stimulation of V3. Similarly, rotation of the electrode in the cephalad direction targets V1.

Special attention should be paid to any signs of unwanted cranial

nerve stimulation (especially CN's VI and VII). The cannula is repositioned (turned more medially, laterally, or most often withdrawn slightly) if necessary. These responses will be unnecessary if the electrode is not advanced more than 5 mm beyond the clival line.

Most patients require a short-acting intravenous anesthetic for lesioning. After the initial lesion is made at 65 degrees for 60 seconds, the patient is awakened and careful fine-touch sensory testing (using a dull needle) is performed to assess the degree of numbness in the desired distribution of the nerve. Sensation may be tested for pinprick and light touch responses and compared with those of the contralateral side.

If the first lesion fails to produce the desired numbness, subsequent lesioning is performed by raising the temperature (in 5-10 degrees Celsius increments). Often additional doses of intravenous anesthesia are unnecessary and the patient can guide sensory lesioning. Mild facial flushing often occurs in the skin regions innervated by the corresponding division. Although this phenomenon is not reliably localizing, it warns me about potential lesioning in unwanted territories (V1).

Continuous sensory tests should be performed after each lesioning attempt. Once moderate hypalgesia is achieved in the afflicted nerve distribution, the patient is retested after 15-20 minutes to ensure that the lesion is fixed. Motor functions in masseter, pterygoids, ocular, and facial muscles are tested along with corneal reflex. Patients are discharged within 2-4 hours after surgery.

Pearls and Pitfalls

- Patient cooperation is instrumental for successful completion of radiofrequency lesioning. Overly anxious or demented patients should not undergo this procedure.

- The tip of the needle should not extend more than 10 mm beyond the clival line as CN's IV or VI would be at risk.
- Aggressive lesioning may lead to bothersome numbness and dysesthesia and therefore should be avoided.
- I do not recommend the use of radiofrequency lesioning for V1 trigeminal neuralgia because of the risk of corneal numbness. Balloon compression rhizotomy is a preferred percutaneous modality in this patient group.

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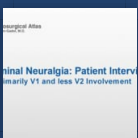
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