Experiment HM-6: M Waves

Equipment Required

PC or Mac Computer

IXTA, USB cable, Power supply for IXTA

ROAM and electrode lead wires

HV stimulator lead wires

Disposable electrodes - round electrodes work best.

Figure HM-6-S2: The IX-TA, ROAM and stimulating electrodes attached..

Stimulating and Recording Electrode Setup

1. Locate the muscles of the lower leg over which the stimulating and recording electrodes will be placed. Muscles can be located by flexing or extending the foot and noting the areas of the lower leg where the muscles are tense during these foot positions.

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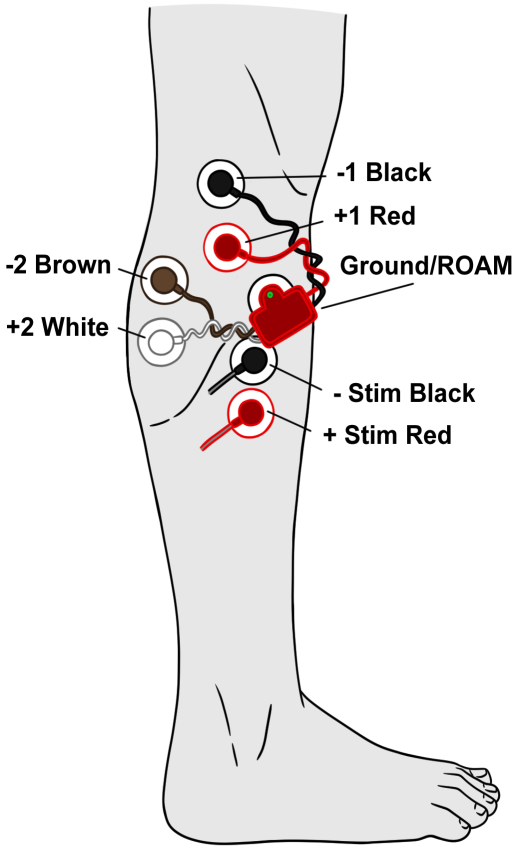

Figure HM-6-S7: Arrangement of the stimulating, ground, and recording electrodes on the back and outside of the right leg.

2. Apply five electrodes over the tibialis anterior muscle (Figure HM-6-S7)
    - Remove the plastic disk from a disposable electrode and place the center of the electrode about 5cm below the knee cap, on the head of the tibialis anterior muscle.
    - Place each of the remaining electrodes in a line extending down the center of the muscle.
4. Apply two electrodes over the gastrocnemius (calf) muscle:
    - Place the topmost electrode behind the knee and centered between the medial and lateral edges of the knee.
    - Place the center of the second electrode just below the first, on the belly of the muscle.

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ROAM Setup

1. Remove the ROAM from the dock.
2. Snap the recording lead wires onto the electrodes, so that:
    - the red "+1" lead wire is attached to the distal electrode on the tibialis anterior muscle.
    - the black "-1" lead wire is attached to the middle electrode on the tibialis anterior muscle.
    - the white "+2" lead wire is attached to the distal electrode on the gastrocnemius muscle.
    - the brown "-2" lead is attached to the electrode on the gastrocnemius muscle above the white one.

Positioning of the Stimulating Electrodes

Determine the positions for the stimulating electrode that cause the muscles of the leg to create a strong twitch response.

Warning: Make sure the Amplitude in the Stimulator Control Panel is set to zero (0).

Note: Disconnect the subject from the IXTA prior to powering off the device.

1. Connect the color-coded stimulator lead wires to the High Voltage stimulator. Make sure you push the safety connector of each lead wire into the appropriate socket on the HV stimulator as far as possible.
2. Instruct the subject to remove all jewelry from the leg being used in the experiment.
3. For Exercises 1 and 2, snap the ends of the stimulator lead wires onto the stimulating electrodes over the tibialis anterior muscle, so that:
    - the black (-) lead is on the topmost electrode below the ground.
    - the red (+) lead is on the electrode directly below the black one.
    - the red (+) lead is on the topmost electrode over the muscle.
    - the black (-) lead is on the electrode directly below the topmost electrode on the muscle.

ALTERNATE ELECTRODE PLACEMENT

Switch both the red and black recording electrode placement with the stimulating electrodes placement

1) Move the recording electrodes to where the stimulating electrodes are currently
2) Move the stimulating electrodes so that the red (+) lead is on the topmost electrode over the muscle and the black (-) lead is on the electrode directly below the topmost electrode on the muscle.

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IXTA Isolated Stimulator

The IXTA has a high voltage stimulus isolator designed to deliver constant current to the nerve or muscle being studied. In situations where the resistance (R) along the path of the current increases, the voltage (V) increases to maintain the current (I in V = IR, Ohm's Law). The ability of the IXTA to adjust the voltage to deliver the required current is known as voltage compliance. The upper limit of this compliance by the IXTA is set at 100 Volts.

Constant current devices differ from constant voltage devices when presented with an increase in resistance, like the dehydration of the conductive gel under the electrodes. As pointed out earlier, a constant current stimulator is voltage compliant. In constant voltage stimulators, the current delivered to the tissue decreases as the resistance increases because the power supply of the constant voltage device is not designed to deliver additional current.

Although the IXTA can generate up to 100 Volts, the current delivered by the unit is limited to a maximum of 20 milliamperes, for a maximum duration of 10 milliseconds per pulse, and a maximum frequency of 50 pulses per second (Hz). At these levels, the maximum amount of power delivered by the IXTA will not cause injury or tissue damage.

The current is selected using the Stimulator Control Panel. The HV Stimulator can deliver a maximum output of twenty milliamperes

The duration, frequency, and number of stimulus pulses generated by the stimulator are also controlled making changes to the values in the Stimulator Control Panel. The initial values of the pulses generated by the IXTA are programmed by the same settings file that configured the recording software. For example, if a pulse from the IXTA is programmed for a duration of 1 millisecond and a frequency of 1 Hz, the stimulator will generate a stimulus pulse with the same duration and frequency.

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