Experiment HP-10: Visual Evoked Potentials (VEP)

Equipment Required

PC or Mac Computer - preferably 2 per station or a 2nd monitor

IXTA, USB cable and power supply

iWire-B3G cable and leads

Electrodes

Eye Patch (use your hand to cover your eye)

Note – Connect the iWire-B3G prior to turning on the IXTA unit.

Electrode Cable Setup

1. Locate the iWire-B3G cable and electrode lead wires.
2. Insert iWire-B3G connector on the end of the cable into the isolated inputs of the iWire 1 channel of the IXTA.
3. Select one person from your group to be the subject in this experiment.
4. Use alcohol swabs to clean the skin where the electrodes will be placed. Three electrodes will be placed on the head:
    - one is high on the forehead, slightly to the left or right of the centerline.
    - one is located just at the edge of the eyebrow, between the eyebrow and the hairline.
    - one is on the occipital area, about two inches above the nape of the neck.
    - Place an elastic headband around the subject's head to hold the electrodes in place. The headband should be placed as high over the ear as possible. The headband should be tight enough so that it does not slide up or down, but not so tight that it is uncomfortable.
    - Trim the electrodes to make them a bit smaller prior to removing the plastic protective covering. Apply the electrodes to the proper locations.
    - The electrodes need to have as little hair as possible under their centers.

See images below for recommended electrode placement.

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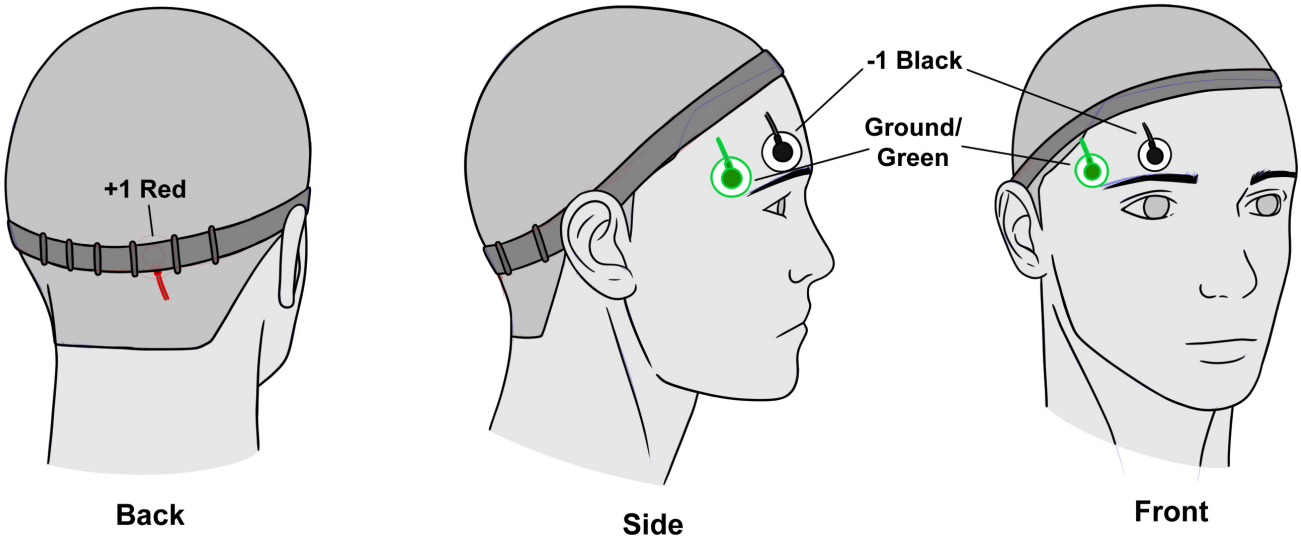
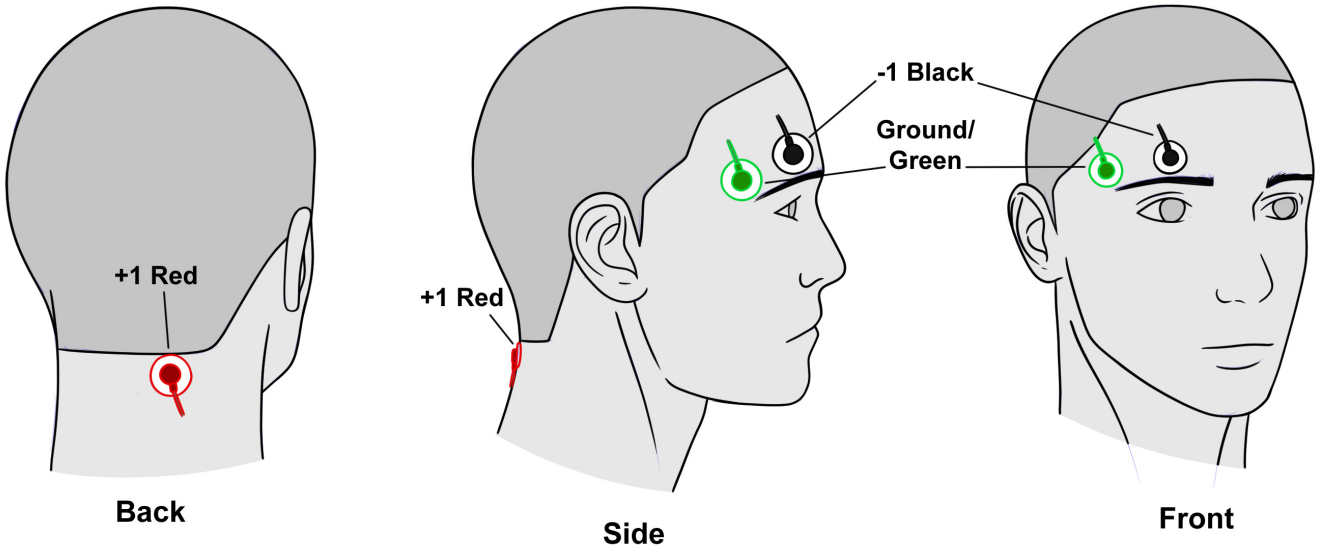
RECOMMEND





Work

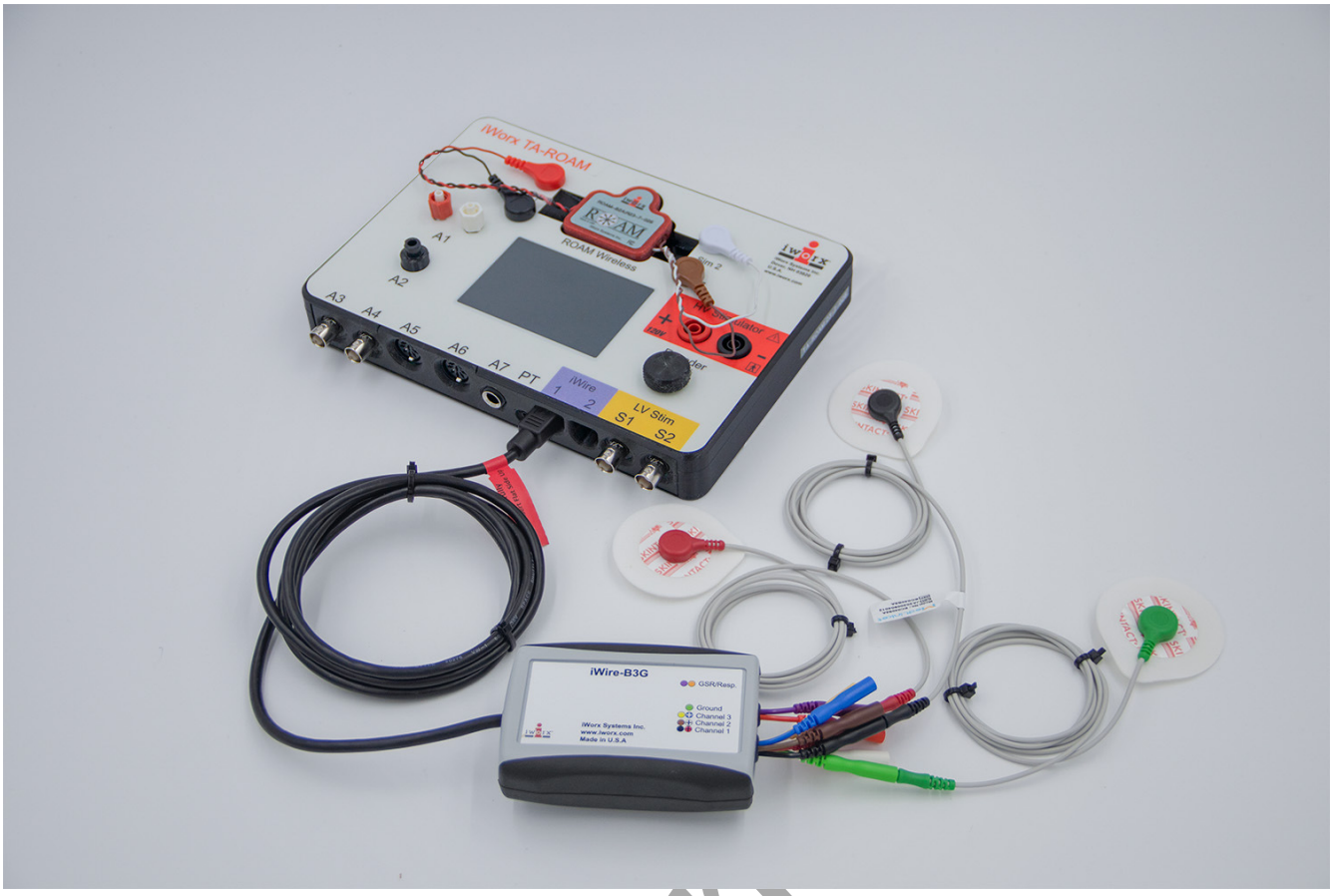


Figure HP-10-S1: The iWire-B3G cable connected to an IXTA.

5. Reusable gold/silver cup electrode buttons can also be used instead of the snap electrodes. If these are used:
    - Place a dab of the tacky conductive gel on each recording electrode before it is placed on the proper location.
    - Place each recording electrode in the proper location.
6. Once the electrodes are in place, attach the three electrode lead wires to the ground and Channels 1 and 2 inputs on the lead pedestal of the iWire-B3G cable.
    - The lead from the electrode on the back of the head at the occipital cortex is connected to the red or +1 input.
    - The lead from the electrode near the center of the forehead is connected to the black or -1 input
    - The lead from the electrode next to the eyebrow is connected to the green (ground).
7. If disposable electrodes are used in the recording setup:
    - Once the electrodes are in place, attach the color-coded lead wires.
8. The lead wire for the electrodes should not hang down in the person's eyes. Drape it loosely over the top of the subject's head. .

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9. The subject should sit quietly with their hands in their lap watching a computer monitor showing the images for VEP testing.

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Experiment HP-10: Visual Evoked Potentials (VEP)

Exercise 1: Recording the Subject with Eyes Closed

Aim: To learn how to record from the subject while the eyes are closed.

Approximate Time: 15 minutes

Procedure

1. Ask the subject to sit quietly and not move unless told to do so, and to keep their eyes closed during this phase of the experiment.
2. Click on the Record button.
3. Type the **<Subject's Name>-Eyes Closed** in the Mark box. Click the Mark button to attach the comment to the data. Continue recording for approximately one minute.
4. Click Stop to halt recording.
5. Select Save As in the File menu, type a name for the file. Click on the Save button to save the data file.

Exercise 2: VEP Testing Patterns

Aim: To identify the VEP pattern for the left eye while looking at a flashing checkerboard.

Approximate Time: 15 minutes

Procedure

1. Instruct the subject that they need to avoid any movement other than opening their eyes when asked. The subject should have their eyes closed at the beginning of the recording.
2. Have the subject cover their right eye with their hand or a patch of some type.
3. Click Record, and then click the AutoScale button on the VEP Response channel. You should observe a recording similar to the beginning of the "eyes closed" recording shown below.
4. Type the letter **C** for Eyes Closed in the Mark box. Click the Mark button to mark the recording. Record for at least one minute.

Note: *It is important to have the video is ready to play immediately as the subject opens their eyes.*

5. While the subject has their eyes closed, type the **Left Eye Checkerboard** in the Mark box. Click the Mark button to mark the recording as you instruct the subject to open their eyes and focus on the dot in the center of the flashing checkerboard pattern. Record the subject's VEP pattern for ten seconds. ***Make sure the subject is only using their left eye.***

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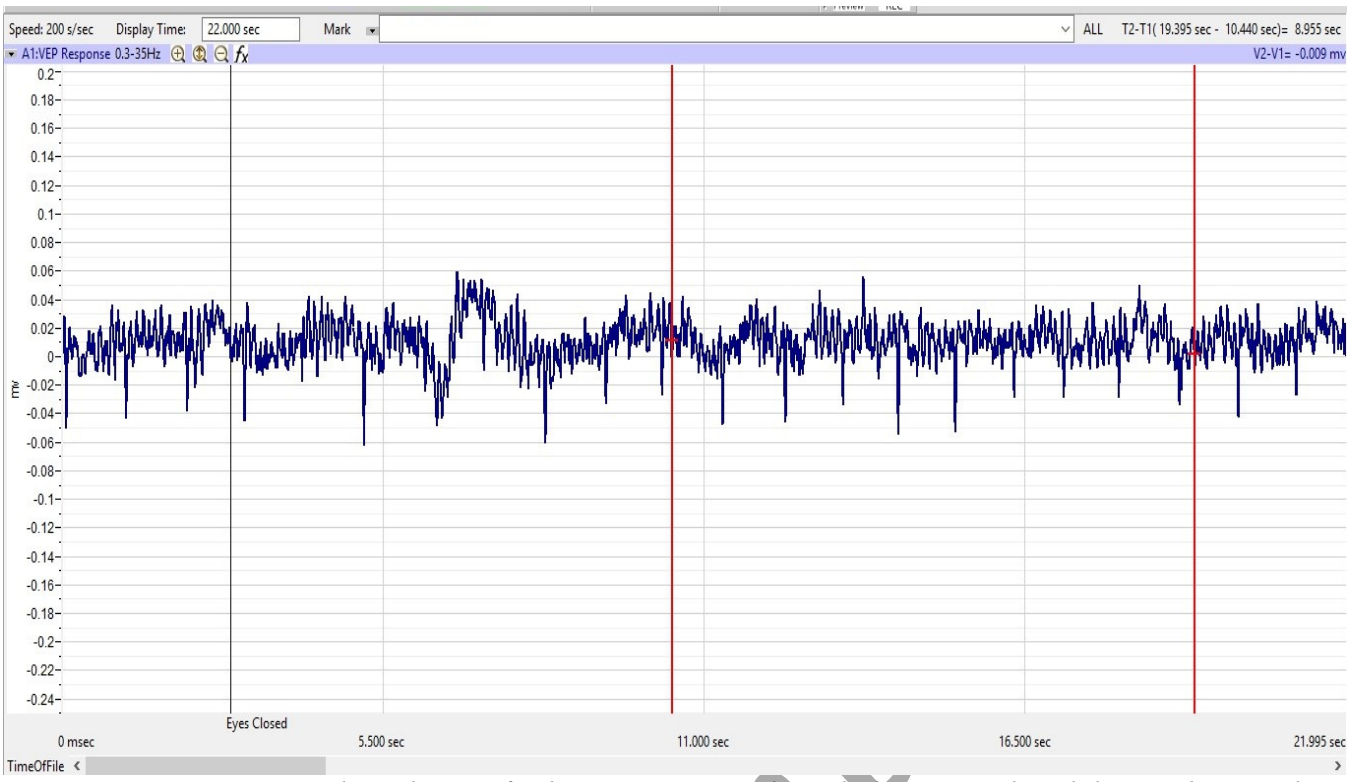

Figure HP-10-L1: Recording shown of subject sitting quietly with their eyes closed during the initial section of the VEP test.

Note: At this time, set up the second computer with the flashing checkerboard pattern video ready to be shown to the subject. One video that can be used is: http:// www.youtube.com/watch?v=xEd1h_lz4rA

6. Click Stop to halt recording. Everytime you stop the recording you have to wait approximately one minute for the baseline to be established.
7. Select Save in the File menu.
8. Have the subject close their eyes and sit quietly for about 10 seconds.
9. Repeat this procedure 10-20 times for the subject's left eye, stopping after each 10 second recording.

Data Analysis

1. Scroll through the data recorded in this exercise and find the first VEP pattern for the subject's left eye and checkerboard pattern.
2. Use the Display Time icons in the LabScribe toolbar to adjust the Display Time of the Main window to show a ten second section of data on the Main window. This section of data can also be selected by:

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- Placing the cursors on either side of the data recorded while the subject's eyes were open.
- Clicking the Zoom between Cursors button on the LabScribe toolbar to expand the period to the width of the Main window.

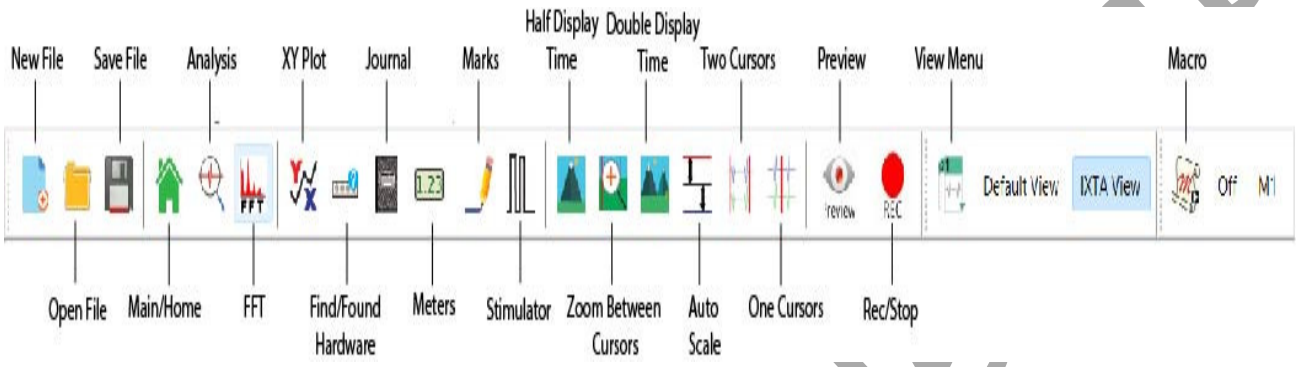

Figure HP-10-L2: The LabScribe toolbar.

3. Data can be collected from the Main window or the Analysis window. If you choose to use the Analysis window, click on the Analysis window icon in the toolbar.
4. The mathematical function T2-T1, Min and Mean should appear on screen. The value for T2-T1 can be seen in the table across the top margin of each channel in the Analysis window, or to the right of each graph in the Main window.

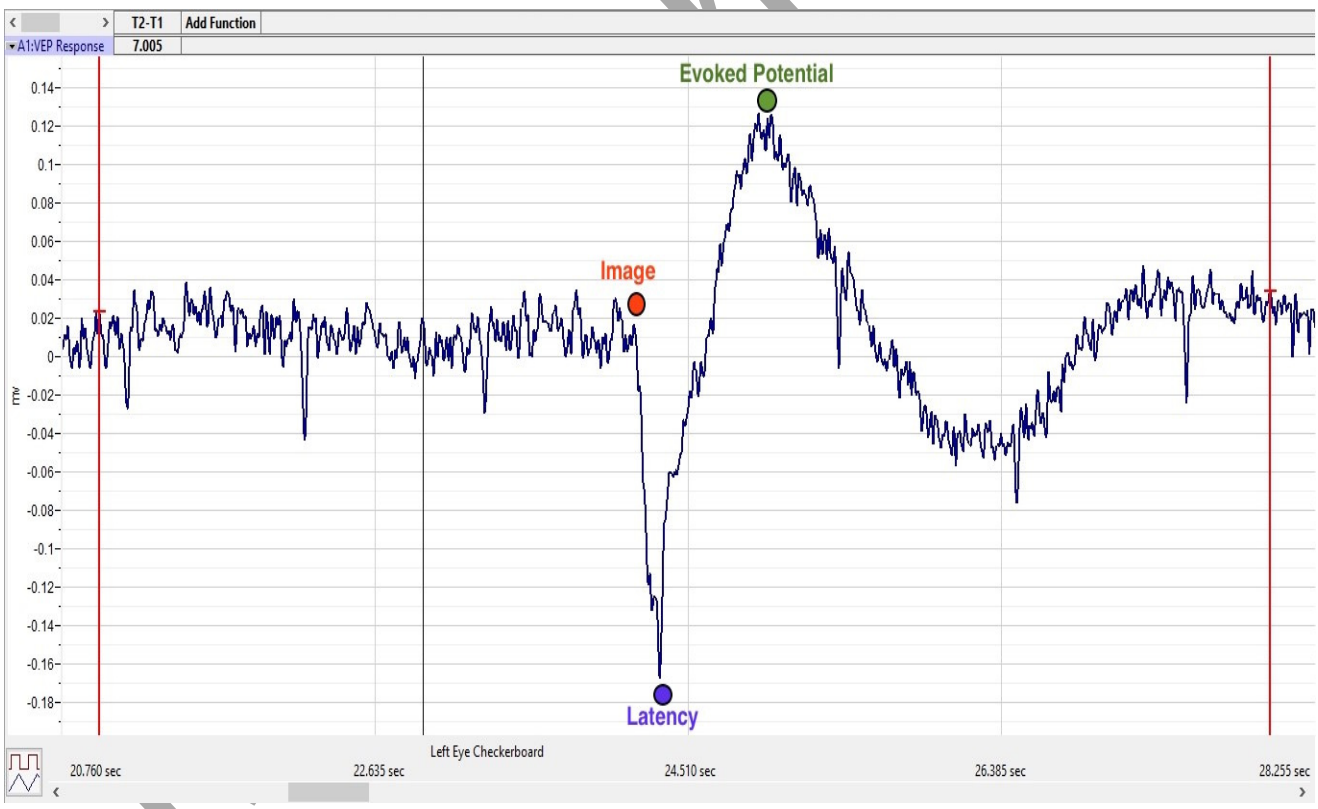

Figure HP-10-L3: Labeled recording of a single VEP response.

5. Once the cursors are placed in the correct positions for determining the time difference between the Latency and Evoked Potentials in the ten-second section of data, the values of these parameters can be recorded in the on-line notebook of LabScribe by typing their names and values directly into the Journal, and in Table 1.
6. The functions in the channel pull-down menus of the Analysis window can also be used to enter the names and values of the means into the Journal. To use these functions:
    - Place the cursors at the locations used to measure the values for the parameters of the VEP pattern in the selected region of data.
    - Transfer the name of the mathematical function used to determine the values of the parameters to the Journal using the Add Title to Journal function in the pull-down menu of any channel.
7. Transfer the values of the parameters of the VEP pattern to the Journal using the Add Ch. Data to Journal function in the VEP Response Channel pull-down menu.

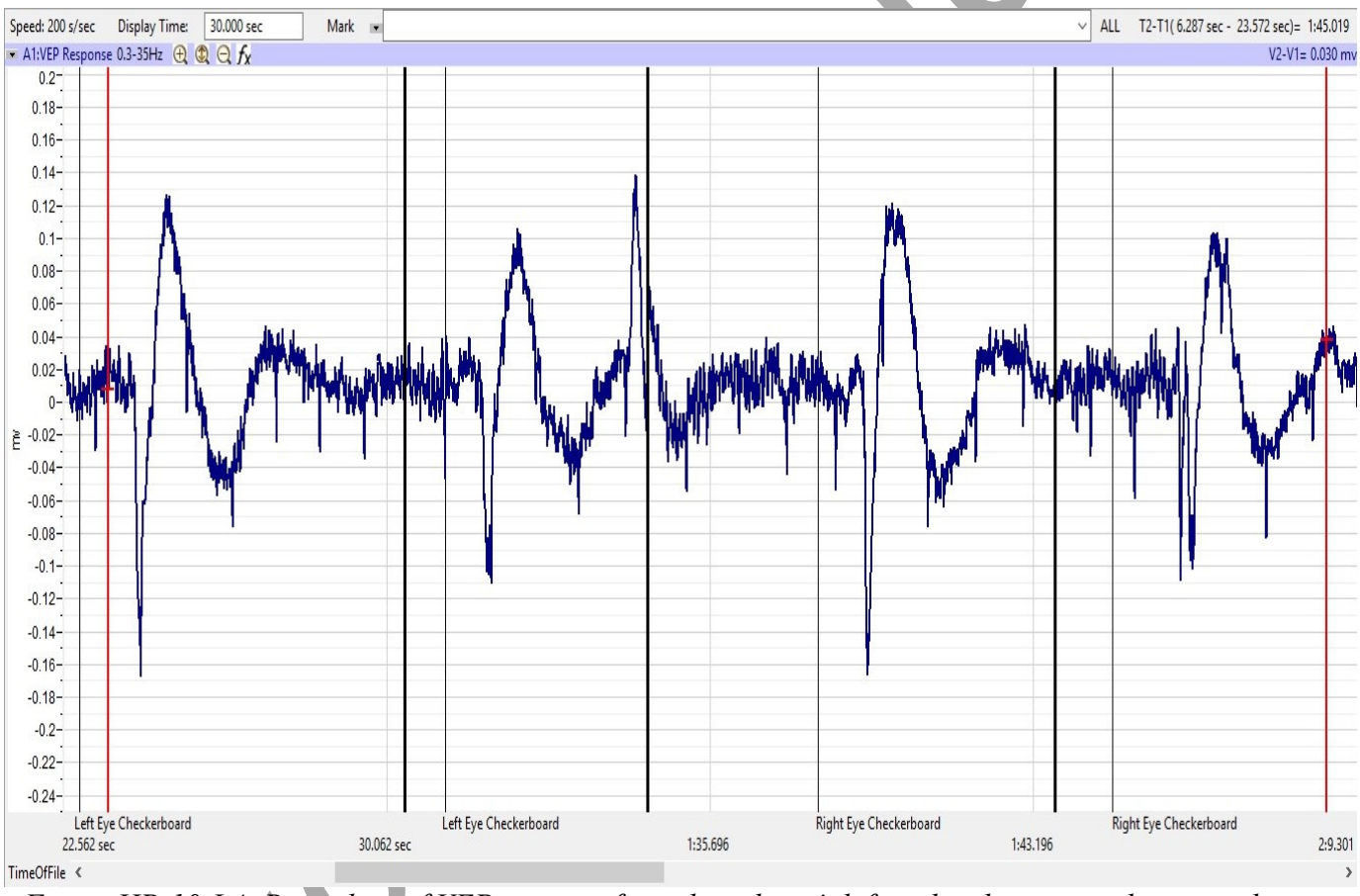

Figure HP-10-L4: Recording of VEP patterns from the subject's left and right eyes as shown on the Main window.

Note – if the recording appears upside-down, click the Invert button using the down arrow to the left of the VEP Response channel.

Wet Lab

8. See the image above for a labeled diagram showing the positions of the cursors:
    - Place 1 cursor on your recording at the area shown by the red dot and the second at the position of the purple dot to measure the T2-T1 value for Latency (the lowest point after the images is shown).
    - Leave the right-hand cursor at the purple dot and move the left-hand cursor to the position of the green dot to measure T2-T1 for the Evoked Potential response (the highest peak after latency).
9. Return to the Main window. Scroll through the recording and find the second recording of the VEP of the left eye while observing the flashing checkerboard.
10. Repeat these steps for the rest of the trials while observing the flashing checkerboard with the left eye. Find the values for T2-T1 for Latency and Evoked Potential and enter this data into the Journal and in Table 1 as performed previously.
11. Select Save in the File menu.

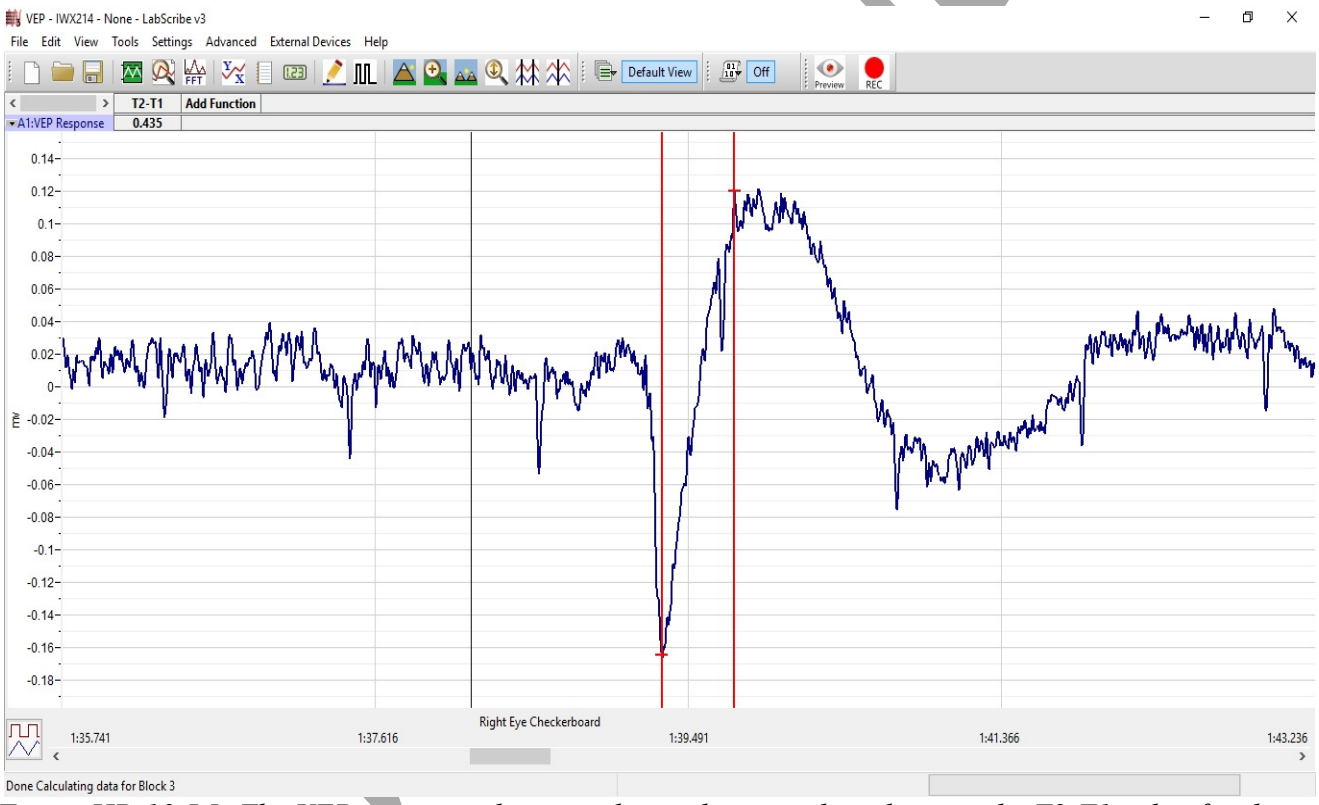

Figure HP-10-L5: The VEP response shown in the analysis window showing the T2-T1 value for the evoked response.

Questions

1. Do each of the ten responses have the same latency? Evoked Potential?
2. Why or Why not?

Work Sample

3. Explain what is happening physiologically during the latent period.
4. What is actually occurring during the Evoked Potential?

Table HP-10-L1: Checkerboard - VEP Latency Period and Response Time for the Left Eye

Trial Number	VEP RESPONSE TIME - Checkerboard Left Eye	
	Latency (sec)	Evoked Potential (sec)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
MEAN		

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Table HP-10-L2: Checkerboard - VEP Latency Period and Response Time for the Right Eye

Trial Number	VEP RESPONSE TIME - Checkerboard Right Eye	
	Latency (sec)	Evoked Potential (sec)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
MEAN		

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Exercise 3: VEP Testing using the Checkerboard Pattern

Aim: To identify the VEP pattern for the right eye while looking at a flashing checkerboard.

Approximate Time: 15 minutes

Procedure and Data Analysis

1. Repeat the procedure for both recording experimental data and data analysis as shown in Exercise 2 using the right eye.
2. Enter the data in the Journal and in Table 2.

Exercise 4: VEP Testing using the Moving Dartboard Pattern

Aim: To identify the VEP pattern for the both the left and right eyes while looking at a rotating dartboard pattern.

Approximate Time: 15 minutes

Note: Use the link: http://www.youtube.com/watch?v=GYIIw0vGDk4 for the rotating dartboard pattern for VEP testing.

Procedure and Data Analysis

1. Repeat the procedure for both recording experimental data and data analysis as shown in Exercise 2. Make sure to do both eyes independently.
2. Enter the data in the Journal and on the two data tables: Table 3 and Table 4.

Questions

1. Is there a difference in the Latency period for the left eye between the checkerboard pattern and the dartboard pattern?
2. Is there a difference in the Latency period with the right eye between the two patterns?
3. Is there a difference in the T2-T1 value Evoked Potential for the right and left eyes between the checkerboard and dartboard patterns?

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Table HP-10-L3: Dartboard - VEP Latency Period and Response Time for the Left Eye

Trial Number	VEP RESPONSE TIME - Dartboard Left Eye	
	Latency (sec)	Evoked Potential (sec)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
MEAN		

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Table HP-10-L4: Dartboard - VEP Latency Period and Response Time for the Right Eye

Trial Number	VEP RESPONSE TIME - Dartboard Right Eye	
	Latency (sec)	Evoked Potential (sec)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
MEAN		

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