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Biopac Student Lab® Lesson 10
ELECTROOCULOGRAM (EOG) I
Data Report
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ELECTROOCULOGRAM

- *EOG*

DATA REPORT

Student's Name: A. T. P. Amarasekara
Lab Section: EOG
Date: 20/03/2023

I. Data and Calculations

Subject Profile

Name: A. T. L. Abeygunathilaka______________________________ Height: 5' 7''_______________

Age: 22_____________ Gender: Male / ~~Female~~ Weight: 68kg_______________

A. **Pendulum Tracking**—Complete Table 10.1.

Note: Your data may have more or fewer cycles than the 7 allotted in the tables.

Table 10.1 Pendulum Tracking vs. Simulation Tracking (using Horizontal data)

Cycle	Pendulum		Simulation	
	40 Delta T	40 P-P	40 Delta T	40 P-P
1	1.1400s	0.5399mV	1.4400s	0.8390mV
2	1.1600s	0.4928mV	1.4700s	0.8189mV
3	1.1300s	0.4715mV	1.3000s	0.7799mV
4	1.1800s	0.4404mV	1.3200s	0.6848mV
5	1.1200s	0.3262mV	1.2700s	0.5952mV
6	1.1000s	0.2631mV	1.3500s	0.4858mV
7	1.1200s	0.2022mV	1.5500s	0.4997mV

B. **Vertical Tracking**—Complete Table 10.2.

Table 10.2 Vertical Tracking vs. Simulation

Cycle	Real Object		Simulation	
	41 Delta T	41 P-P	41 Delta T	41 P-P
1	5.5400s	0.1459mV	1.9700s	0.1807mV
2	5.3500s	0.1394mV	1.9500s	0.0989mV
3	4.3900s	0.1062mV	2.0400s	0.0872mV
4	4.0500s	0.0921mV	2.1400s	0.1372mV
5	4.3600s	0.1033mV	1.5700s	0.1023mV
6				
7				

C. **Saccades**—Complete Table 10.3.

Table 10.3 Saccades

Measurement	*Read Silently 1*		*Read Silently 2*		*Read Aloud*	
	1st line	*2nd line*	*1st line*	*2nd line*	*1st line*	*2nd line*
Number of words	**9**	**9**	**7**	**7**	**7**	**7**
Number of saccades	**9**	**9**	**7**	**7**	**7**	**7**
Time interval between saccades #1	0.14s	0.09s	0.11s	0.04s	0.19s	0.18s
#2	0.23s	0.20s	0.18s	0.10s	0.19s	0.10s
#3	0.27s	0.16s	0.08s	0.14s	0.11s	0.13s
#4	0.13s	0.11s	0.08s	0.09s	0.14s	0.09s
#5	0.16s	0.11s	0.20s	0.32s	0.32s	0.24s
#6	0.14s	0.10s	0.15s	0.12s	0.09s	0.13s
#7	0.13s	0.15s				
#8	0.14s	0.12s				
#9						
Average time interval between saccades (Calculate)	0.14875		0.134167		0.159167	

II. Questions

D. Focusing a camera changes the distance between the lens and the film. Does the eye focus by changing the distance between the lens and the retina? Explain your answer.

Since the positions of the lens of the eye and the retina cannot be changed, the length between the lens and the retina does not change. Therefore, the image distance (distance between lens and the image) for objects at any distance is the same. Hence in order to focus on the object, the eye changes the power of the lens (or the focal length of the lens) by changing the curvature of the lens, allowing the lens to focus on objects at any distance.

E. Define the following terms:

Cone – In the human eye, a cone is a specialized type of photoreceptor cell that is responsible for color vision and visual acuity and they are located in the retina. There are three types of cones, each of which is most sensitive to a particular range of wavelengths of light, namely, short-wavelength cones (S-cones), medium-wavelength cones (M-cones), long-wavelength cones (L-cones). Cone dysfunction can result in color blindness or other visual impairments.

Rod – Rod is another type of photoreceptor cell which is located in the retina and is responsible for vision in low light conditions. Rods are much more sensitive to light than cones, but they are not sensitive to color. Instead, they are responsible for detecting changes in light and dark and providing peripheral vision. Rods contain a light-sensitive pigment called rhodopsin, which is made up of a protein called opsin and a molecule called retinal. When light strikes the retina, it causes retinal to change shape, which triggers a chemical reaction that ultimately leads to the transmission of signals to the brain, allowing us to see. Rod dysfunction can result in night blindness or other visual impairments.

Fovea – It is a small, central area pf the retina in the eye which is responsible for sharp, detailed vision since it contains a high concentration of cone cells. It is located at the back of the eye, near the optic nerve, and is surrounded by a region called the macula. Fovea contains fewer blood vessels and other structures which can scatter light, allowing for a much clearer vision._When looking directly at an object, light form that object is focused onto the fovea allowing us to see it in sharp detail and the rest of the retina is responsible for the peripheral vision.

Visual Field – It is the entire area that a person is able to see while looking straight ahead. It includes everything that is visible to both eyes, including objects that are in front, to the side, above, and below. The visual field is divided into two parts, each corresponding to one eye, and there is some overlap between the two fields.

Visual Fixation **-** Ability of the eyes to maintain a stable gaze on a specific object or point in space. It is an important aspect of visual perception and is necessary for tasks such as reading, driving, and other activities that require precise eye movements.

Saccade / Microsaccade **-** Saccades are rapid eye movements that occur during visual fixation, which allow the eyes to quickly and accurately shift their gaze from one point to another. Microsaccades are a type of saccade that are smaller in amplitude and occur during fixation on a stationary object.

F. Why is vision in darkness more effective when focusing away from the fovea rather than focusing directly on the fovea?

Rods which are responsible for vision in darkness are located towards the peripheral of the retina. When focusing directly on an object with the fovea, in low light conditions, the rod cells are not as effective at detecting the small amount of light that is available. However, when focusing away from the fovea, the light falls on a larger area of retina, including the rod cells, allowing vision in low light conditions.

G. Explain the difference between “voluntary fixation” and “involuntary fixation”:

Voluntary fixation is a conscious and intentional movement of the eye to focus on a specific object or location in the visual field. For example, when reading a book, eyes are voluntarily fixated on the words on the page.

Involuntary fixation is an automatic and unconscious movement of the eye that allows you to keep a selected object in the visual field once it has been found.

H. Examine the data in Table 10.1 and answer the following questions

a.) Did the amplitude continue to decrease with each successive swing cycle during pendulum tracking? Explain

Yes, the amplitude values decrease with each successive swing cycle since the horizontal deviation from the midpoint decreases gradually as the pendulum swings and hence less muscle activity is needed to track the pendulum causing a gradual reduction in the amplitude.

b.) Did the amplitude continue to decrease with each successive swing cycle during simulated pendulum tracking? Explain

Yes. The amplitude values have been decreased with each successive swing cycle due to the reason explained above. However, it is not as uniform as the actual pendulum tracking since the subject was having difficulty in mimicking the motion in his mind without the presence of a pendulum.

c.) Did the time interval (period) of each successive swing cycle increase, decrease, or remain constant during pendulum movement? Explain
The time intervals are constant for most of the swing cycles with random fluctuations.

d.) Did the time interval (period) of each successive swing cycle increase, decrease, or remain constant during simulated movement? Explain
The time intervals fluctuate with no particular order but overall the swing cycles periods remained almost constant. This is mostly due to inability of subject to actually mimic the pendulum motion. Also, the time periods have increased from the pendulum motion to simulated pendulum motion.

e.) Are the waveform shapes different between tracking and simulated tracking data? Explain
The waveforms for the tracking movement gradually decreased over time. However, for the simulated tracking, the waveform was irregular and had no exact pattern unlike for the actual tracking movement. This could be due to the subject guessing the pattern instead of having an actual pendulum to follow the motion.

I. Examine the data in Table 10.2 and answer the following questions:

a.) Do the cycle amplitudes increase, decrease, or remain constant during vertical tracking? Explain

The cycle amplitudes remain almost constant although slight fluctuations have occurred. This could be due to the director not maintain the same upper and lower levels in each cycle.

b.) Do the cycle amplitudes increase, decrease, or remain constant during simulated vertical tracking? Explain

In the simulated vertical tracking as well, the amplitudes remain almost constant since the subject has a control of how long the vertical tracking will be. However, the values of the amplitudes have significantly decreased compared to the actual vertical tracking motion due to the shorter range of the simulated motion.

c.) Do the cycle periods increase, decrease, or remain constant during vertical tracking? Explain

The cycle periods have decreased with each successive cycle according to the recorded data. This could be due to the director moving the pen with irregular time intervals.

d.) Do the cycle periods increase, decrease, or remain constant during simulated vertical tracking? Explain

The cycle periods have varied with no identifiable pattern due to the irregular vertical simulation of the pen by the subject.

e.) Are the waveform shapes different between vertical tracking and simulated vertical tracking data? Explain

The waveforms of the vertical tracking with the pen has a gradual variation of the signal while. The waveforms of the simulated vertical tracking have jerky movements and is not as smooth as the pen tracking as the subject has no object to focus on.

J. Examine the data in Table 10.3 and answer the following questions:

a.) Did the number of saccades match the number of words for each line? Explain any differences.

Yes, the number of saccades has matched with the no. of words.

b.) Is the average time interval between saccades different when reading an easy passage vs. a challenging passage? Explain

When comparing the reading silently conditions for easy and challenging passages, the subject has taken more average time intervals in-between saccades for the easy passage than for the challenging passage. This could be due to the subject not fully reading each word properly in challenging passage as they are difficult.

c.) Is the average time interval between saccades different when reading the same passage silently vs. aloud?

The average time interval is higher when the passage is read aloud compared to reading silently. This could be due to the subject having to fully read the words when saying it out loud rather than skipping some words when reading silently.

d.) Are the waveform shapes different between Read Silently 2 and Read Aloud data? Explain

Yes, the waveforms are wider in reading out loud when compared to the silently reading waveform.

K. Name the cranial nerves tested and the extraocular muscles tested when the subject is asked to follow the eraser on a pencil when moved in a one foot circle, two feet from face.

Cranial Nerves	Extraocular Muscles
Oculomotor (CN 3)	Superior rectus
Trochlear (CN 4)	Lateral rectus
Abducens (CN 6)	Medial rectus
	Inferior rectus
	Superior oblique
	Inferior oblique

L. Define corneal–retinal potential (CRP) and explain its relation to electrooculography and the electrooculogram. CPR refers to the electrical potential difference between the cornea (front of the eye) and the retina (back of the eye). This potential difference arises due to the separation of electrical charges between the photoreceptor cells in the retina and the pigment epithelium in the eye.

Electrooculography (EOG) is a technique used to measure the CRP by pacing electrodes on the skin around the eye. This records the eye's electrical activity that occurs due to the changes in the CRP when eye moves.

Electrooculogram is a graphical representation of the electrical activity recorded by the EOG electrodes. This is used to diagnose and monitor various eye conditions, including nystagmus (fast and uncontrollable movements of the eye), strabismus (when the two eyes don't line up in the same direction, aka "crossed eyes" or "walleye") and other eye movement disorders.

End of Lesson 10 Data Report