SUB CLINICAL VISUAL DISORDERS IN HIGH RISK YOUNG POPULATION

Dr. Shalini Rastogi [1]*, Dr. Shobitha Muthukrishnan [2] and Dr. Manish Kumar [3]

[1] Associate Professor, Department of Physiology, School of Medical Sciences and Research, Sharda University, Greater Noida. *Corresponding Author Email: shalini.rastogi@sharda.ac.in
[2] Professor& Head of Department, Department of Physiology, School of Medical Sciences and Research, Sharda University, Greater Noida.
[3] Assistant Professor, Department of Physiology, School of Medical Sciences and Research, Sharda University, Greater Noida.

DOI: 10.5281/zenodo.13780533

Abstract

Objective of the study: According to Hoffmann et al. (2017), visual evoked potentials (VEPs) are collected through the presentation of pattern stimuli or light flashes. VEPs are used to identify injuries to the visual pathway, which includes the occipital cortex, optic radiations, optic chiasm, optic nerve, and retina. Electrodes are implanted on the subject's head above the visual cortex, and a gray field with a grating or checkerboard pattern is alternatively shown to elicit a VEP response. The VEP is formed when the checkerboard boxes or stripes are large enough to be identified (Hoffmann et al., 2017). While VEP cannot pinpoint the exact reason, it can indicate visual impairments that are missed by standard physical exams or magnetic resonance imaging (MRI) (Hoffmann et al., 2017). Many conditions can result in abnormal VEP, including multiple sclerosis, demyelinating disease, neurosyphilis, glaucoma, tumor compressing the optic nerve, optic neuritis, brain injury, retrobulbar neuritis, aluminum or manganese intoxication, toxic amblyopia, metabolic disorders like diabetes, optic neuropathy, migraine, ischemic heart disease, vitamin B12 deficiency, ocular hypertension, Friedreich's ataxia, and ischemic heart disease. In order to identify aberrant visual pathways that can result from delayed maturation, it is also utilized to evaluate visual impairment in babies (Hoffmann et al., 2017). **Background:** VEPs, or visually evoked potentials, are used to identify neurological or ophthalmological conditions. It has been proposed that one of the variables influencing VEP is gender. Therefore, in order to determine the gender differences in several visual characteristics and VEPs, a preliminary investigation was carried out. Methodology: In order to assess gender-based variations in VEPs and visual metrics, the Sharda School of Medical Sciences and Research at Sharda University conducted a cross-sectional questionnaire survey over a two-month period. A self-structured questionnaire was divided into two parts. The survey was split into two sections: part I included questions about the demographics of the pupils, and part II included fifteen questions regarding visual attributes and VEP evaluations. The questionnaire was distributed to one hundred first-year undergraduate medical students. They will answer any questions for thirty minutes. An appropriate statistical analysis was carried out. A P value of less than 0.05 was considered significant. Results: Of the 100 pupils who completed the questionnaire, 50 were male and 50 were female. Male and female participants had mean ages of 19.94 ± 1.3 years and 19.6 ± 1.0 years, respectively. Between the two genders, statistically significant differences were found in visual disturbances and eye strain. Studies on VEP piqued the interest of female students more. Conclusion: The study evaluated the survey for assessing subclinical visual impairments in high-risk male and female first-year MBBS student populations. Female students were found to be a higher-risk demographic, more likely to experience subclinical abnormalities in neurological and ophthalmologic illnesses.

Keywords: VEP Questionnaire, Gender High Risk in Undergraduates, Visual Metrics.

INTRODUCTION

Evoked potentials (EPs) are electric potentials recorded in a specific pattern from a specific region of the brain in response to a stimulus. They come in various forms, including somatosensory, steady-state, visual, auditory, and motor. VEPs are non-invasive and can help identify neurological and retinal conditions associated with the brain or optic nerve. The two main components of VEPs are stimulus amplitude and latency, which can be influenced by factors such as age, gender, head circumference, and attention level. Technical considerations include stimulus box size, distance between eye and stimulus point, monitor type, and lighting. Anthropometric and gender parameters are significant physiological determinants that can influence VEP measures. However, research on gender associations in VEP parameters has produced contradictory findings. This initial questionnaire research aims to assess the influence of gender variations in visual attributes on VEP.

Clinical Significance of VEP:

Visual Emission Patterns (VEPs) are sensitive signals for abnormalities in the visual pathway caused by demyelinating or axonal diseases. Variations in latency and conduction time indicate demyelinating diseases, while changes in amplitude and shape indicate axonal injury.

Neuro-ophthalmological Field: VEPs are used in neuro-ophthalmology to monitor and measure damage to optical neuropathies, distinguish between retinal and optic nerve disorders, and differentiate between cortical blindness and malingering.

Neurological Field: The study found that female participants had worse visual acuity compared to male participants, similar to a previous study in Tbilisi. This could be due to variations in visual acuity, which can affect responses captured in Visual Experimentation (VEP). Female students also had higher prevalence of visual disturbances and discomfort, which is consistent with previous research showing women are more affected by ocular illnesses at all ages. Gender disparities in ocular symptoms may also be influenced by societal, cultural, and hormonal factors.

AIM AND OBJECTIVES

Research Question: How does the gender affect VEPs and visual parameters in healthy first year medical undergraduate students?

Aim: To figure out how a student's gender affects their first-year VEPs and visual characteristics.

Primary Objective: The main objective is to determine how gender affects the VEPs of first- year, healthy medical students.

Secondary Objective: Assessing gender-based variations in the visual metrics among healthy first-year medical undergraduates is the secondary objective.

METHODOLOGY

The purpose of this study was to evaluate the gender differences in the visual characteristics and VEP among undergraduate medical students. Numerous variables, including gender and visual acuity, can influence VEPs. Although gender differences in sleep, stress, visual acuity, and visual discomfort are not well understood, they can lead to vision-related problems including blurred vision and photophobia, which can then have an impact on VEP recordings. Therefore, the purpose of this study was to evaluate these differences among students in good health, both genders, which were free of neurological or ocular disorders at the time of the investigation. In order to evaluate the gender-based differences in VEPs and visual metrics, a two-month cross- sectional questionnaire survey was administered

ISSN 1462 2815

to first-year medical students at Sharda School of Medical Sciences and Research, Sharda University. After receiving approval from the institutional ethics committee, the study was launched. Two pieces of a self-structured questionnaire were created. The students' demographic information was included in part I, and there were fifteen questions in part II that dealt with the evaluation of visual metrics and VEPs. The questionnaire was given to the students who gave their written, informed consent to take part in the study. They had 30 minutes to finish the questionnaire and were told to respond to every question. The completed surveys were gathered from the students.

Statistical Procedure

The following two stages were taken in the statistical procedures:

Data Collection

After the data was transferred from a pre-coded proforma to a computer, it was methodically collated, and Microsoft Excel was used to create a master table. The entire set of data was arranged in a sensible way and displayed as separate tables and graphs.

Title: Gender Based Variations in Visual Evoked Potentials in medical undergraduates: Preliminary Questionnaire Analysis

APPENDIX I: QUESTIONNAIRE

Initials of the student:

Gender: A. Male B. Female C. Other: _______

Age: _______

MBBS year: _________

1. On average, how many hours per day do you spend looking at screens (computers, phones, tablets, etc.)?
   A. More than 5 hours
   B. 3 to 5 hours
   C. Less than 3 hours
2. How many hours of sleep do you typically get per night?
   A. More than 8 hours
   B. 6 to 8 hours
   C. Less than 6 hours
3. How often do you stay up all night studying?
   A. Rarely
   B. Occasionally
   C. Frequently
4. On a scale of 1 to 10, how would you rate your average stress level? (1 being low, 10 being high)

   ____

ISSN 1462 2815

5. Are you familiar with visual evoked potentials (VEPs)?
   A. Yes
   B. No
6. Would you be interested in participating in VEP studies?
   A. Yes
   B. No
   C. Maybe
7. How would you rate your visual acuity?
   A. Excellent C. Fair
   B. Good D. Poor
8. Are you experiencing any visual disturbances at present (e.g., blurriness of vision, flashes of light, photophobia)?
   A. Yes
   B. No
9. How often do you experience eye strain or visual discomfort?
   A. Rarely
   B. Occasionally
   C. Frequently
10. Do you have any history of vision-related issues?
    A. Yes, if yes, please specify: ______
    B. No
11. Do you have any diagnosed neurological conditions or disorders?
    A. Yes, if yes, please specify: ______
    B. No
12. When did you have your last visual acuity check?
    A. Within last one month
    B. Within last three months
    C. Within last six months
    D. Before six months
13. How would you describe your performance on visual tasks (e.g., reading speed, visual reaction time)?
    A. Excellent
    B. Good
    C. Fair
    D. Poor
14. Do you take any medications that may affect visual processing?
    A. Yes, if yes, please specify: ______
    B. No

ISSN 1462 2815

15. Do you think it is important to understand gender-based variations in neuroscience research?
    A. Yes
    B. No

Feel free to provide any extra information you feel is relevant to this study:

Analytical Statistics-

Microsoft Office Excel was used to tabulate the data that was gathered. Version 23.0 of the Statistical Package for Social Science (SPSS) was used to analyse the data. Mean, standard deviation for quantitative variables, frequency, and proportion were used to compute descriptive statistics for explanatory and outcome factors. Pearson's Chi square test was used to compare the gender differences between the two groups. χ2 can be calculated using the following

formula: ∑(Oi – Ei)2/Ei where "O" is observed and "E" is expected. The sigma symbol ∑ means sum of what follows.

Significant figures:

Significance (P value 0.05 < P ≤ 0.01≤0.00)

Non-significance (P value > 0.05)

RESULTS

In this study, gender-based variations in VEPs and other visual metrics among undergraduate medical students were evaluated using preliminary questionnaire analysis. The questionnaire was distributed to 100 students in total, 50 of them were male and the remaining 50 were female. The participants' average age was 19.94 ± 1.3 years for males and 19.6 ± 1.0 years for females. Results of the questionnaire survey: Table 1 and Figure 2 show that, on average, 15 female participants (60%) and 10 male participants (40%) looked at screens (computers, phones, tablets, etc.) for more than five hours a day. Thirty-two (52.2%) male and thirty-two (47.8%) female participants looked at screens for three to five hours a day on average (computers, phones, tablets, etc). P < 0.05 indicated statistical significance in the results.

Table 1: Gender Variation in the Hours per day Spent looking at Screens (Computers, Phones, Tablets, etc.)

	OPTION	FEMALE N (%)	MALE N (%)	TOTAL N (%)
A	>5 hours	15	10	25
		60.0%	40.0%	100.0%
B	3 to 5 hours	32	35	67
		47.8%	52.2%	100.0%
C	<3 hours	3	5	8
		37.5%	62.5%	100.0%
P-Value		0.042*		

ISSN 1462 2815

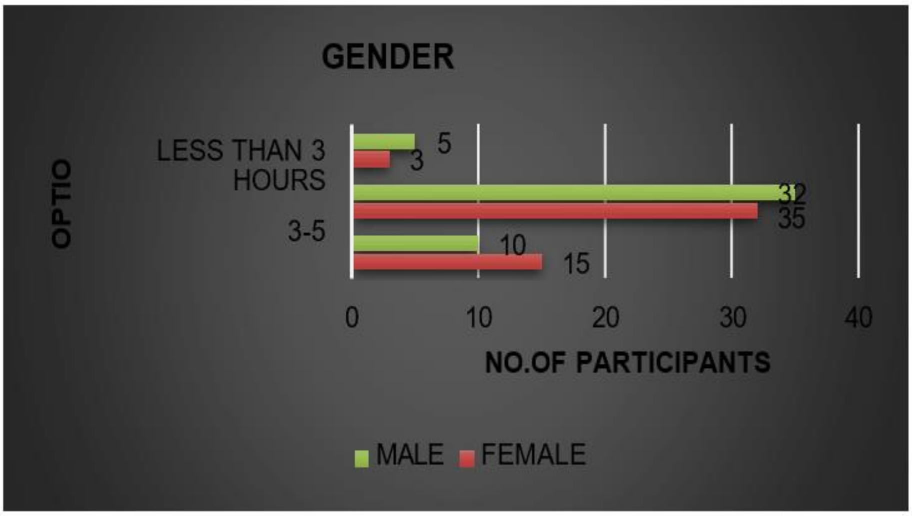

Figure 1: Gender Variations in the hours per day spent looking at screens

The individuals' stated levels of stress are displayed in Table 2. It was discovered that, for their average stress level, 2 (33.3%) female participants gave a minimum score of 2, while 1 male participant gave a score of 0. Three individuals (60.0%) who were female and two participants (40.0%) who were male gave the highest stress score of 10. P > 0.05 indicated that the results were not statistically significant.

Table 2: Gender variations in average stress levels of participants (1 being low, 10 being high)

	OPTION	FEMALE N (%)	MALE N (%)	TOTAL N (%)
A	0	0	1	1
		0.0%	100.0%	100.0%
B	1	0	1	1
		0.0%	100.0%	100.0%
C	2	2	4	6
		33.3%	66.7%	100.0%
D	3	2	1	3
		66.7%	33.3%	100.0%
E	4	2	9	11
		18.2%	81.8%	100.0%
F	5	13	10	23
		56.5%	43.5%	100.0%
G	6	7	7	14
		50.0%	50.0%	100.0%
H	7	10	4	14
		71.4%	28.6%	100.0%
I	8	8	9	17
		47.1%	52.9%	100.0%
J	9	3	2	5
		60.0%	40.0%	100.0%
K	10	3	2	5
		60.0%	40.0%	100.0%
P-Value		0.367		

Male participants knew more about the VEPs than female participants did (52.8% vs. 47.2%), however table 3 shows that this difference was not statistically significant (P > 0.05).

Table 3: Gender variation in familiarity with VEPs

	OPTION	FEMALE N (%)	MALE N (%)	TOTAL N (%)
A	Yes	25	28	53
		47.2%	52.8%	100.0%
B	No	25	22	47
		53.2%	46.8%	100.0%
P-Value		0.344		

Of the 100 students, 83 (83%), 42 men and 41 women, thought it was critical to comprehend how gender affects differences in neuroscience research. A statistically significant ($P < 0.05$) difference was seen between the number of female participants who were interested in taking part in VEP studies and the number of male students. Thirteen (44.8%) female and sixteen (55.2%) male individuals had no interest in taking part in VEP studies, whereas 33 (50.8%) female and 32 (49.2%) male participants expressed interest in doing so. Table 4 and Figure 3 below provide the specifics.

Table 4: Gender Variation in Interest in Participating in VEP Studies

	OPTION	FEMALE N (%)	MALE N (%)	TOTAL N (%)
A	Yes	33	32	65
		50.8%	49.2%	100.0%
B	No	13	16	29
		44.8%	55.2%	100.0%
C	May be	4	2	6
		66.7%	33.3%	100.0%
P -Value		0.001*		

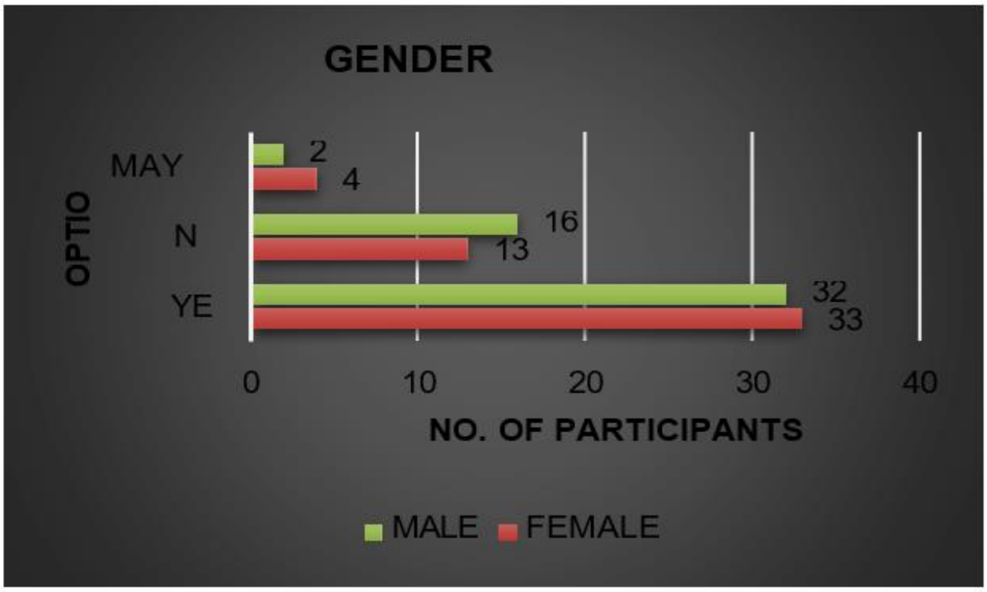

Figure 2: Gender variation in interest in participating in VEP studies.

Figure 3 shows that within the recent month, one participant (10.0%) and six (90.0%) female participants had their visual acuity checked. Within the previous six months, 19 (63.3%) male and 11 (36.7%) female subjects underwent their most recent visual acuity examinations. The final visual acuity test was performed before six months for 28 (56.0%) female participants and 22 (44.0%) male individuals. Table 5 shows that all of the gender variances were statistically significant ($P < 0.05$).

www.commprac.com
ISSN 1462 2815

Table 5: Gender variation in the frequency of visual acuity check

	OPTION	FEMALE N (%)	MALE N (%)	TOTAL N (%)
A	Within last one month	6	1	7
		90.0%	10.0%	100.0%
B	Within last	5	8	13
	three months	38.5%	61.5%	100.0%
C	Within last six months	11	19	30
		36.7%	63.3%	100.0%
D	Before six months	28	22	50
		56.0%	44.0%	100.0%
P - Value		0.032*		

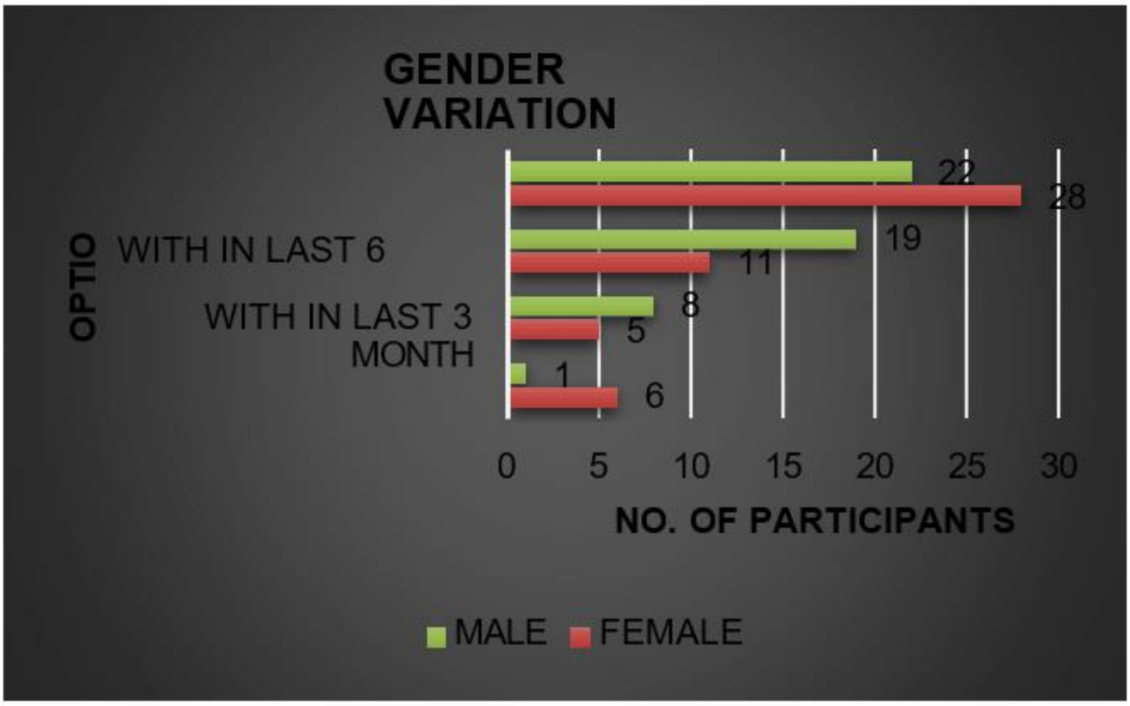

Figure 3: Gender Variation in the Frequency of Visual Acuity Check.

DISCUSSION AND CONCLUSION

Discussion

According to the survey, female students not only slept longer and slept in later at night, but they also spent more time in front of screens overall. Studies have indicated that females need more sleep than do men (Mehta, Shafi, & Bhat, 2015). 802 medical students from three different medical schools had poor overall sleep quality, with an average sleep duration of 5.74 hours per night, which is regarded as inadequate sleep, according to a recently published Nigerian research (Aderinto et al., 2024).

According to a study by Fatima et al. (2016), which involved 3778 young adults in Australia, the prevalence of poor sleep quality was greater in women than in men (65.1% in women against 49.8% in men). The study also assessed the sleep quality and related risk factors. It was discovered that lifestyle, sociodemographic, and psychological characteristics had little bearing on women's poor sleep quality (Fatima, Doi, Najman, & Mamun, 2016).

Similarly, women were shown to have a considerably higher prevalence of sleep disorders than men in a cross-sectional study conducted in Jordan (Alosta et al., 2024). Bixler et al. (2009), in contrast, state that women's sleep quality is superior to men's. When compared to men of the same age, they found that younger women slept longer and went deeper into sleep, but that this diminished with menopause (Bixler et al., 2009).

The study found that female participants had worse visual acuity compared to male participants, similar to a previous study in Tbilisi. This could be due to variations in visual acuity, which can affect responses captured in Visual Experimentation (VEP). Female students also had higher prevalence of visual disturbances and discomfort, which is consistent with previous research showing women are more affected by ocular illnesses at all ages. Gender disparities in ocular symptoms may also be influenced by societal, cultural, and hormonal factors.

Gender-based research is therefore critically needed in ophthalmology in order to help provide patients with the best possible care that is grounded in objective data. The responses on the VEP are impacted by modifications in visual characteristics including visual acuity. Numerous variables can impact visual parameters, including sleep deprivation, prolonged computer or smart phone use, and more.

These conditions can all lead to changes in visual parameters, which can then alter VEP responses. For both genders, these parameters could be different. Therefore, it's critical to comprehend how gender differs in the visual parameters in order to assess high-risk VEP patients for any neurological or ophthalmological conditions.

This will assist in the early detection and treatment of the illness, hence lowering the morbidity that is related to it. In order to assess the gender differences in visual metrics and VEP among first-year undergraduate medical students, this study was carried out.

Conclusion

The purpose of the study was to evaluate the survey for assessing subclinical visual impairments in high-risk male and female first-year MBBS student populations. The study found that female participants had worse visual acuity compared to male participants, similar to a previous study in Tbilisi. This could be due to variations in visual acuity, which can affect responses captured in Visual Experimentation (VEP).

Female students also had higher prevalence of visual disturbances and discomfort, which is consistent with previous research showing women are more affected by ocular illnesses at all ages. Gender disparities in ocular symptoms may also be influenced by societal, cultural, and hormonal factors.

References

1) Hoffmann, M. B., Brands, J., Behrens-Baumann, W., & Bach, M. (2017). VEP- based acuity assessment in low vision. *Documenta ophthalmologica. Advances in ophthalmology, 135*(3), 209-218. doi:10.1007/s10633-017- 9613-y

2) Eklund, A., Huang-Link, Y., Kovácsovics, B., Dahle, C., Vrethem, M., & Lind, J. (2022). OCT and VEP correlate to disability in secondary progressive multiple sclerosis. *Multiple sclerosis and related disorders, 68*, 104255. doi:10.1016/j.msard.2022.104255

3) Evans, A. B. (2019). Clinical Utility of Evoked Potentials. Retrieved from https://emedicine.medscape.com/article/1137451-overview?form=fpf

4) Fatima, Y., Doi, S. A., Najman, J. M., & Mamun, A. A. (2016). Exploring Gender Difference in Sleep Quality of Young Adults: Findings from a Large Population Study. *Clinical medicine & research, 14*(3-4), 138-144. doi:10.3121/cmr.2016.1338

5) Hamilton, R., Bach, M., Heinrich, S. P., Hoffmann, M. B., Odom, J. V., McCulloch, D. L., & Thompson, D. A. (2021). VEP estimation of visual acuity: a systematic review. *Documenta ophthalmologica. Advances in ophthalmology, 142*(1), 25-74. doi:10.1007/s10633-020-09770-3

6) Hassankarimi, H., Jafarzadehpur, E., Mohammadi, A., & Noori, S. M. R. (2020). Low-contrast Pattern-reversal Visual Evoked Potential in Different Spatial Frequencies. *Journal of ophthalmic & vision research, 15*(3), 362-371. doi:10.18502/jovr.v15i3.7455

7) Steffensen, S. C., Ohran, A. J., Shipp, D. N., Hales, K., Stobbs, S. H., & Fleming, D. E. (2008). Gender-selective effects of the P300 and N400 components of the visual evoked potential. *Vision Research, 48*(7), 917-925. doi:https://doi.org/10.1016/j.visres.2008.01.005

8) Thompson, D. A., & Liasis, A. (2017). Chapter 9 - Visual electrophysiology: How it can help you and your patient. In S. R. Lambert & C. J. Lyons (Eds.), *Taylor and Hoyt's Pediatric Ophthalmology and Strabismus (Fifth Edition)* (pp. 68-75). London: Elsevier.

9) Trick, G. L., & Skarf, B. (2011). Visual Evoked Potential. Retrieved from https://entokey.com/visual-evoked-potential/

10) VandenBos, G. R. (2015). *APA dictionary of psychology, 2nd ed*. Washington, DC, US: American Psychological Association.

11) Walsh, P., Kane, N., & Butler, S. (2005). The clinical role of evoked potentials. *Journal of neurology, neurosurgery, and psychiatry, 76 Suppl 2*(Suppl 2), ii16-22. doi:10.1136/jnnp.2005.068130

12) Zheng, X., Xu, G., Zhang, K., Liang, R., Yan, W., Tian, P., . . . Du, C. (2020). Assessment of Human Visual Acuity Using Visual Evoked Potential: A Review. *Sensors (Basel, Switzerland), 20*(19). doi:10.3390/s20195542

13) Ziccardi, L., Cioffi, E., Barbano, L., Gioiosa, V., Falsini, B., Casali, C., & Parisi, V. (2021). Macular Morpho-Functional and Visual Pathways Functional Assessment in Patients with Spinocerebellar Type 1 Ataxia with or without Neurological Signs. *Journal of clinical medicine, 10*(22). doi:10.3390/jcm10225271

14) Patterson Gentile C, Joshi NR, Ciuffreda KJ, Arbogast KB, Master C, Aguirre GK. Developmental Effects on Pattern Visual Evoked Potentials Characterized by Principal Component Analysis. Transl Vis Sci Technol. 2021 Apr 01;10(4):1. [PMC free article] [PubMed]

15) Jashari, A., Brand, A., Roinishvili, M., Kunchulia, M., Sierro, G., Willemin, J.,. . . Grzeczkowski, L. (2016). *Gender differences in visual perception* (Vol. 16).

16) Jurkute, N., & Robson, A. G. (2021). Electrophysiology in neuro- ophthalmology. *Handbook of clinical neurology, 178*, 79-96. doi:10.1016/b978-0-12-821377-3.00019-2

17) Leocani, L., Guerrieri, S., & Comi, G. (2018). Visual Evoked Potentials as a Biomarker in Multiple Sclerosis and Associated Optic Neuritis. Journal of neuro-ophthalmology : the official journal of the North American Neuro- Ophthalmology Society, 38(3), 350-357. doi:10.1097/wno.0000000000000704

18) Mahajan, Y., Ching, A., Watson, T., Kim, J., & Davis, C. (2022). Effect of sustained selective attention on steady-state visual evoked potentials. *Experimental brain research, 240*(1), 249-261. doi:10.1007/s00221-021-06251-0

19) Barbano, L., Ziccardi, L., & Parisi, V. (2021). Correlations between visual morphological, electrophysiological, and acuity changes in chronic non- arteritic ischemic optic neuropathy. Graefe's archive for clinical and experimental ophthalmology = Albrecht von Graefes Archiv fur klinische und experimentelle Ophthalmologie, 259(5), 1297-1308. doi:10.1007/s00417-020-05023-w

20) Bixler, E. O., Papaliaga, M. N., Vgontzas, A. N., Lin, H. M., Pejovic, S., Karataraki, M., . . . Chrousos, G. P. (2009). Women sleep objectively better than men and the sleep of young women is more resilient to external stressors: effects of age and menopause. *Journal of sleep research, 18*(2), 221-228. doi:10.1111/j.1365-2869.2008.00713.x

21) Clayton, J. A., & Davis, A. F. (2015). Sex/gender disparities and women's eye health. *Current eye research, 40*(2), 102-109. doi:10.3109/02713683.2014.986333

22) Creel, D. J. (2019). Chapter 34 - Visually evoked potentials. In K. H. Levin & P. Chauvel (Eds.), *Handbook of Clinical Neurology* (Vol. 160, pp. 501-522): Elsevier.

23) Mathew, J., Masson, G. S., & Danion, F. R. (2020). Sex differences in visuomotor tracking. *Scientific reports, 10*(1), 11863. doi:10.1038/s41598- 020-68069-0

24) Mehta, N., Shafi, F., & Bhat, A. (2015). Unique Aspects of Sleep in Women. *Missouri medicine, 112*(6), 430-434.

25) Odom, J. V., Bach, M., Brigell, M., Holder, G. E., McCulloch, D. L., Mizota, A., & Tormene, A. P. (2016). ISCEV standard for clinical visual evoked potentials: (2016 update). *Documenta ophthalmologica. Advances in ophthalmology, 133*(1), 1-9. doi:10.1007/s10633-016-9553-y

26) Park, S. H., Park, C. Y., Shin, Y. J., Jeong, K. S., & Kim, N. H. (2022). Low Contrast Visual Evoked Potentials for Early Detection of Optic Neuritis. *Frontiers in neurology, 13*, 804395. doi:10.3389/fneur.2022.804395.