



Optic Neuritis: Evaluation of Visual Acuity and Contrast Sensitivity. A Hospital Based Cross Sectional Study

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Abstract

Objective: To assess visual acuity and contrast sensitivity in various form of Optic neuritis patients. **Study Design and Settings:** It was a hospital based cross sectional study conducted in eye department of Teaching hospital, University of Lahore Pakistan. Total duration of the study was 4 months from January 2022-April 2022. **Methodology:** A total of 32 patients were included in the study. Purposive sampling technique was adopted for sampling. Patients age 15-45 were included in the study. A detail eye examination was done in patients presented to eye department with pain and evaluated for optic neuritis, and demographics along with clinical signs and symptoms were documented using a proforma. **Results:** Total 32 patients were included in the study having Optic Neuritis. Mean age of the patients was $29 \pm 8.3SD$ (Range 15-45). The optic neuritis was divided into further sub-divisions, i.e. Pappilits 11 patients, Retrobulbar Neuritis 14 patients and neuroretinitis 7 patients. A paired t test comparing contrast sensitivity before and after treatment showed a significance of .03 improvement after treatment. In spite of the fact that the results demonstrated that contrast sensitivity did not return to normal, they did show that with prompt treatment, a substantial improvement in contrast sensitivity was possible. Same significance of .02 was found for improvement in VA post-operatively when a paired t test was applied. **Conclusion:** Vision and contrast sensitivity both are affected in ON, however VA can be improved to normal vision after treatment but contrast seldom improve to its normal value.

Key Words: Contrast Sensitivity; Optic Neuritis; Vision

Introduction:

Inflammation of the optic nerve is known as optic neuritis (ON). Primary demyelination in a disease spectrum that encompasses multiple sclerosis (MS) (typical ON) or secondary inflammation and demyelination from other causes can both produce inflammation atypical ON. Demyelination of the optic nerve is believed to be the outcome of an inflammatory autoimmune response in both the normal MS-associated ON and in cases of solitary ON ([Backner et al., 2019](#)), ([Asseyer et al., 2023](#)). It is now

becoming more common. It can develop because of autoimmune, infectious, or inflammatory diseases ([Wang et al., 2023](#)). Women between the ages of 15-45 are more likely to develop optic neuritis. The most common symptom is a sudden loss of eyesight, which is worse during the first week and then gradually improves ([Salmon, 2019](#)).

The ability of the eye to distinguish shapes and features at unusual distances is known as visual acuity ([Bennett, 2019](#)). The amount of light reaching the eye is regulated by the iris then it strikes the transparent lens which has an ability of focusing light on to the retina ([Palmer et al., 2018](#)). The visual acuity of approximately two-thirds of people with optic neuritis is between 0 and 1.5. In the Optic Neuritis Treatment Trial (ONTT), over 60% of patients had their vision restored after two months, and only 6% of patients had acuity of less than 0.5 six months after commencement. Increases were seen in a variety of visual faculties, including color vision, CS, and VFs ([Morrow et al., 2018](#)).

Contrast sensitivity testing is essential because it enables us to detect various visual dysfunctions at an early stage and get a complete picture of a patient's visual health. Distinction between low- and high-contrast items may be impaired in certain disorders, but high-contrast object recognition may be unchanged. Assessing a patient's contrast sensitivity is a subjective way to gauge their visual potential and reveal insights into their eye health ([Osborne & Balcer, 2023](#)). Most of the time, the contrast between an object and its background is lower than it would be on a Snellen chart. Because of this, we can learn why some patients complain of reduced vision and visual functioning in everyday life despite having the same level of visual acuity as others.

Our study's goal was to assess contrast sensitivity and visual acuity in individuals with various forms of optic neuritis, both before and after treatment, in order to determine the visual functions i.e. contrast sensitivity and vision affected by the disease and its recovery after treatment.

Objectives:

To assess visual acuity and contrast sensitivity in various form of Optic neuritis patients.

Methodology

It was a hospital based cross sectional study conducted in University of Lahore teaching hospital and other multicenter hospitals. Sample size was calculated using WHO calculator and it was 32, with 95 % CI and 80% power of the study. Total duration of the study was 4 months. Purposive sampling a non-probability sampling technique was used for sample collection. Patients between age 15-45 years with optic neuritis and other autoimmune systemic conditions were included without any gender discrimination. Individuals with diabetes, mental retardation and having surgical eye procedures were excluded. A detail eye examination was done starting from history, visual acuity, contrast sensitivity refraction by an Optometrist and then for detail examination by an ophthalmologist, for Optic Neuritis. Visual acuity of the patients was assessed using log MAR chart and Peli Robson chart was used for contrast sensitivity. Taking in consideration the ethical aspect of the study, Ethical review was obtained from the UOL ERB (REC-UOL-62-01-2023). Informed consent was taken from the patients prior to the study and the study was conducted using in mind the Helsinki Declaration. Data analysis was done using IBMS, SPSS version 25 for descriptive statistics like mean, standard deviation and frequencies. Paired t test was used for pre and post treatment contrast sensitivity and vision recovery.

Results:

Total 32 patients were included in the study having Optic Neuritis. Out of that 20 were females and 12 were males. Mean age of the patients was $29 \pm 8.3SD$ (Range 15-45). The optic neuritis was divided into further sub-divisions, i.e. Pappilits 11 patients, Retrobulbar Neuritis 14 patients and neuroretinitis 7 patients. Mean visual acuity was found about 0.48 with $\pm 0.378SD$ with a range of (.00-1.0) Log MAR. Mean contrast sensitivity with Peli Robson chart was calculated about 0.90 with a SD of ± 0.60 Log Unit. Depending upon the severity of the condition recorded VA was further classified into mild having VA < 0.20 log MAR, moderate from 0.30-0.60, and sever from 0.70-1.0 Log MAR. Contrast sensitivity was also divided into three categories mild (1.90 Log Unit), Moderate (< 1.5 Log Unit) and severe (< 1 Log Unit). The resolution of these cases was determined by an improvement in VA to 0 log MAR or up to

0.05 Log MAR, but not a return to normalcy in contrast sensitivity. However, a paired t test comparing contrast sensitivity before and after treatment showed a significance of .03 improvement after treatment. In spite of the fact that the results demonstrated that contrast sensitivity did not return to normal, they did show that with prompt treatment, a substantial improvement in contrast sensitivity was possible. Same significance of .02 was found for improvement in VA post-operatively when a paired t test was applied.

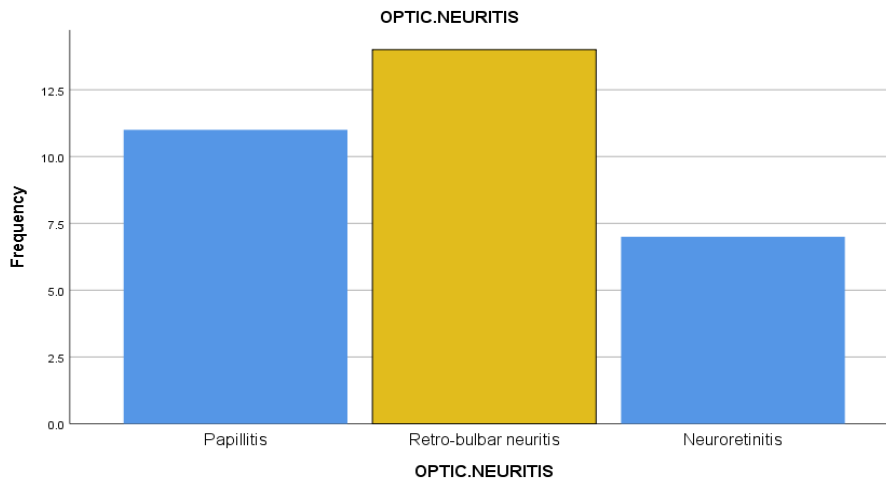


Figure 1: Frequency Bar Graph of different types of Optic Neuritis included in the study

Table 1: Frequencies of Patients with Mild, Moderate and Severe level of reduced contrast sensitivity and Visual Acuity

Frequencies of Patients	Mild (≤ 1.90 Log Unit for CS) for VA < 0.2	Moderate (< 1.20 Log Unit) VA 0.3-0.60	Severe (< 0.60 Log Unit) VA 0.7-1.0
Contrast Sensitivity	01	14	17
Visual Acuity	12	05	15
Total	32		

Table 2: Paired t test results of Pre and Post Treatment Contrast Sensitivity and Visual Acuity in Optic Neuritis Patients.

	Paired Differences					df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
				Lower	Upper		
Pre Treatment CS - Post Treatment	0.90250	0.60370	0.0134	0.1566	1.90005	31	0.03
Pre Treatment VA-Post Treatment VA (Log MAR)	0.48	± 0.378	0.256	1.00	0.00	31	0.02

Discussion:

In our study about 63% were females compare to males that were around 38 %. Mean age of the patients was 29 years with ± 8.3 SD (Range 15-45). Literature showed that females were more affected by the Optic neuritis compare with males. Studies published internationally also showed female predominance ([Oreja-Guevara et al., 2022](#)). However some studies also showed predominance of male ([Collorone et al., 2021](#)). The logic behind ON in females is still unclear, however the male face a worse visual outcomes and fast progression. This may be due to estrogen hormones level in females that can act as neuro-protective mechanism suggested by some literature ([Ambika et al., 2018](#)). Literature suggests that although males experienced more severe form of ON, they did not find any significant differences in visual recovery across sexes. This apparent discrepancy between structure and function in the ON model could be due, in part, to the fact that high-contrast acuity testing and Optic Nerve Fiber layer thickness on OCT is a rather insensitive method of identifying visual dysfunction in individuals with ON. ([Huang et al., 2019](#)).

Unilateral Optic Neuritis was more common in our study compared to binocular ON. Fig.1 showed that three primary forms of ON were identified as having the most impact on individuals in our study. Retrobulbar Neuritis was more common followed by Pappilits and Neuroretinitis. A study published in India showed contradictory results with respect to our study as Pappilits was the most common type of ON. However studies done in past also showed that Retrobulbar Neuritis was the most common type of ON ([Rajkarnikar, Gurung & Pant, 2021](#)). Literature showed that Patients with an acute inflammatory phase, those recovering from optic neuritis, those with multiple sclerosis without a history of optic neuritis, and patients with acute inflammatory phases all have decreased contrast sensitivity in low, moderate, and high spatial frequencies . Numerous pathogenic processes, such as inflammation, demyelination, and axonal degeneration of the visual pathway, can cause the visual symptoms of ON to deteriorate ([Sanchez et al., 2023](#)). Further, distinguishing ON from other diseases, such as subclinical ON, is crucial for gauging the course and outcome of the disease. VA, visual field, brain imaging, VEP, OCT, and contrast sensitivity are just few of the diagnostic approaches examined for early identification of ON ([Park et al., 2020](#)).

An initial inflammatory phase following Optic neuritis is characterized by decreased contrast sensitivity across all spatial frequencies ([Sun et al., 2019](#)). The current study showed that reduced contrast sensitivity was found among patients with ON. Table.1 explained the results of further subdivision of CS and VA to mild moderate and severe form depending upon the log MAR value on Peli Robson Chart and VA chart. In the majority of instances, VA and contrast sensitivity both sharply declined. Table 2. Explained the visual and contrast outcome after treatment. It was noted, however, that while VA could be enhanced to 95%, the average contrast sensitivity could only be raised to a mean value of 78%. Literature showed that after 2–4 weeks, patients with optic neuritis typically have an improvement in visual acuity to the 0.6 or greater range. However, both color and contrast perception are diminished. Ten percent of people acquire chronic optic neuritis, characterized by persistent vision impairment and no remissions ([Liberski, Kaluzny & Kocięcki, 2022](#)); ([Salmon, 2019](#)). Our research revealed a reduction in contrast sensitivity of up to 95%. The findings are consistent with the existing body of research. They demonstrated a 93% increase (and, in some cases, a 100% increase) in contrast reduction ([Mahayana, Sakti & Gani, 2022](#)). Previous cases of optic neuritis were also associated with lower contrast sensitivity test scores ([Oreja-Guevara et al., 2022](#)). A study published in Pakistan showed that out of total patients 4 had reduced contrast sensitivity with a significance level of .000 (p value). Acute optic neuritis has an extraordinarily high prognosis for visual acuity, although some individuals suffer chronic significant visual loss after a single episode. In addition, some individuals who have had their vision restored to "normal" still experience discomfort from movement-induced photopsias and transient loss of vision.

The current study showed that with early detection of ON, there is a good chance of improvement in visual acuity, with some cases reaching 6/6 or 6/5. A latest literature showed that VA can be improved in about 73% of patients to 6/12 or even better ([Ambika et al., 2018](#)), ([Naumovska et al., 2018](#)), ([Kowsalya et al., 2023](#)). However, despite treatment, contrast sensitivity still reduced, and in some

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cases, higher spatial frequencies were easily achieved, but low contrast frequencies still remain reduced, which is why patients still complain of photopsia's and transient loss.

Conclusion:

Vision impairment was minimal and quickly recovered from after treatment for optic neuritis. Retrobulbar neuritis was the most common kind of optic neuritis. Visual acuity improved up to 95% after treatment for ON, with most patients falling into the 21-39 age bracket; however, full recovery and restoration of contrast was not achieved.

Limitation(S)

- The study had a short duration.
- The impact could be more effective if the sample size was bigger.

Conflicts of Interest

The authors have no conflict of interests with any other party.

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