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ORIGINAL RESEARCH

Comparative study of visual evoked potentials changes of diabetic retinopathy and non diabetic retinopathy patients in G.G.G Hospital Jamnagar

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ABSTRACT
Diabetic retinopathy (DR) is a severe microvascular complication of diabetes mellitus that affects the retina and can lead to visual impairment. Visual Evoked Potential (VEP) is a non-invasive technique used to evaluate the functional integrity of the visual pathway, particularly in individuals with diabetic retinopathy. This study aims to evaluate and compare VEP responses between diabetic retinopathy patients and healthy controls. Fifty diabetic retinopathy patients and fifty age- and gender-matched controls were included. VEP results showed significantly prolonged P100 and N135 latencies in diabetic retinopathy patients compared to controls, indicating delayed conduction in the visual pathway. These findings support the utility of VEP in the early detection of visual impairment in diabetic retinopathy patients, even before clinical symptoms manifest.

Keywords: Diabetic retinopathy, Visual evoked potential, P100 latency, N135 latency, Visual pathway

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INTRODUCTION

Diabetes mellitus (DM) is a group of metabolic disorders characterized by chronic hyperglycemia, leading to long-term complications that affect various organs, including the eyes.[1] Diabetic retinopathy (DR) is one of the most common and severe microvascular complications of diabetes, eventually affecting nearly all patients with type 1 diabetes and many with type 2 diabetes over time.[2,3] The global burden of diabetic retinopathy continues to rise, making it one of the leading causes of preventable blindness among working-age adults.[1,3] Early detection and intervention are crucial in preventing the progression of diabetic retinopathy to advanced stages, which include proliferative diabetic retinopathy (PDR) and diabetic macular edema (DME).

Visual evoked potential (VEP) is an electrophysiological test that assesses the functional integrity of the visual pathways from the retina to the occipital cortex. It is used to detect optic nerve dysfunction and can be an essential diagnostic tool for diabetic retinopathy, even before the onset of clinical visual symptoms. The latency and amplitude of the VEP responses, particularly the P100 component, are commonly analyzed to detect abnormalities in the visual pathway.[4]

This study aims to assess the VEP responses in diabetic retinopathy patients compared to healthy controls and to evaluate the potential of VEP as an early diagnostic tool in detecting visual impairment in diabetic retinopathy.[5]

METHODOLOGY

Study Design

This study was a combined cross-sectional and case-control study conducted over six months at the Department of Ophthalmology, Guru Govind Singh Government Hospital, Jamnagar. Ethical approval was obtained from the Institutional Review Board, and informed consent was taken from all participants.

Study Population

The study included 100 subjects, divided into two groups:

- **Group 1**: 50 healthy controls, age- and gender-matched.

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- **Group 2**: 50 diabetic retinopathy patients diagnosed based on fundus examination.

Inclusion Criteria:
- Patients aged 30-70 years, diagnosed with diabetic retinopathy.
- Detailed ophthalmologic examination was performed on all participants, including visual acuity tests, slit-lamp examination, intraocular pressure measurement, and dilated fundus examination.

Exclusion Criteria:
- Patients with other ocular conditions that could affect VEP results, such as glaucoma, cataract, and hypertensive retinopathy.
- Patients with neurological disorders that might influence VEP interpretation.

VEP Recording Procedure
Pattern-reversal visual evoked potentials (VEP) were recorded using a standardized protocol. Subjects were seated in front of a black-and-white checkerboard stimulus displayed on a screen, with each eye tested separately. Scalp electrodes were placed over the occipital region, with the reference electrode placed on the forehead. The pattern-reversal stimulus alternated at a rate of two reversals per second.
VEP parameters recorded included the **P100 latency**, **N75 latency**, and **N135 latency**. The P100 latency, which represents the time taken for the visual stimulus to reach the visual cortex, was the primary outcome measure.

Data Collection and Analysis
Data, including blood sugar levels, HbA1c values, and VEP responses, were collected for all participants. Statistical analyses were performed using an unpaired t-test to compare mean latencies between diabetic retinopathy patients and controls. A p-value <0.05 was considered statistically significant.

RESULTS

Demographics
The demographic distribution of participants is presented in **Table 1**. The majority of diabetic retinopathy patients were aged 41-50 years (46%), with males predominating in both the diabetic (70%) and control (66%) groups. The mean duration of diabetes in diabetic retinopathy patients was 9.2 years, with most patients having diabetes for 6-10 years.

Age Group	Diabetic Retinopathy Patients (%)	Controls (%)
30-40	10	24
41-50	46	34
51-60	34	36
61-70	10	6

Table 2 shows the distribution of diabetic retinopathy subtypes. Non-proliferative diabetic retinopathy (NPDR) was more prevalent than proliferative diabetic retinopathy (PDR) in both eyes.

Subtype	Right Eye (%)	Left Eye (%)
NPDR	56	70
PDR	44	30

VEP Results
The mean P100 and N135 latencies in diabetic retinopathy patients were significantly prolonged compared to controls ($p < 0.05$). **Table 3** summarizes the VEP latencies for both groups.

Parameter	Diabetic Retinopathy (mean ± SD)	Control (mean ± SD)	P-value
P100 (RE)	105.29 ± 3.56	100.85 ± 0.45	0.0001
P100 (LE)	105.57 ± 3.196	101 ± 0.44	0.0001
N135 (RE)	152.22 ± 2.24	151 ± 0.645	0.0004
N135 (LE)	150.75 ± 0.645	152.2 ± 2.44	0.0001

Visual Acuity
The visual acuity of diabetic retinopathy patients was significantly lower than that of controls, with more patients in the diabetic retinopathy group having reduced vision. **Table 4** summarizes visual acuity outcomes.

Visual Acuity	Diabetic Retinopathy (%)	Controls (%)
6/6	2	10
6/9	4	13
6/12	20	26
6/18	18	10
<6/60	10	3

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DISCUSSION

The present study evaluates the latency differences in VEP parameters between diabetic retinopathy patients and healthy controls, with a particular emphasis on the P100 and N135 latencies. The increased latency of P100 in diabetic retinopathy patients, compared to controls, is a significant finding, indicating potential disruptions in visual signal conduction. This delay is consistent with the literature, where P100 latency prolongation is commonly associated with optic nerve dysfunction and retinopathy in diabetes patients .

P100 Latency in Diabetic Retinopathy: Our findings demonstrated a statistically significant increase in P100 latency in diabetic retinopathy patients compared to controls, with a p-value of 0.0001. This is in line with previous studies showing that diabetic retinopathy contributes to prolonged latencies due to compromised neural conductivity along the visual pathway.[6,-9] The P100 wave, which reflects the functional integrity of the visual pathways, was significantly prolonged in both eyes of diabetic retinopathy patients . The prolongation is thought to be a consequence of the microvascular damage induced by chronic hyperglycemia, leading to ischemia and dysfunction in the optic nerve and visual cortex .

N135 Latency: The N135 latency was also significantly increased in diabetic retinopathy patients, showing a correlation between prolonged latencies and the duration of diabetes. As seen in our study, the N135 latency reflects deeper visual cortical processing, and its prolongation suggests involvement of more posterior visual pathway components, which aligns with existing electrophysiological findings.[10,11]

Impact of Disease Duration: Our study observed that patients with longer durations of diabetes exhibited more pronounced changes in VEP latencies, particularly P100 and N135. This correlates with literature stating that prolonged diabetes, especially uncontrolled, exacerbates vascular complications leading to retinopathy.[12] This suggests that early diagnosis and better glycemic control could mitigate the progression of these electrophysiological abnormalities.

Comparison with Other Studies: The findings in our study are consistent with several others, including the study by Algan et al., which showed a similar trend in the increase of P100 latencies in diabetic retinopathy patients . Likewise, studies by Corduneanu et al. further support the finding of increased N135 latency with the progression of the disease.[13]

CONCLUSION

In summary, the increase in P100 and N135 latencies in diabetic retinopathy patients highlights the value of VEP in detecting subclinical visual pathway dysfunction. These findings suggest that VEP can serve as a useful diagnostic tool for early detection of diabetic retinopathy progression. Further studies with larger sample sizes and longitudinal data are recommended to validate these results and explore the potential for VEP as a routine screening tool in diabetic retinopathy patients.

By addressing these electrophysiological changes early in the course of diabetes, clinicians may be better able to prevent significant visual impairment. Future research should also explore interventions aimed at reducing these latencies through better glycemic control and possible neuroprotective therapies

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