

Pattern Reversal Visual Evoked Potential (PRVEP) Changes in Patients with Proptosis

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Abstract

Purpose: To assess pattern reversal visual evoked potentials (PRVEP) changes in patients with proptosis.

Methods: This was a cross-sectional, hospital-based study including 40 patients with either unilateral or bilateral proptosis who fulfilled the inclusion and exclusion criteria and gave informed written consent. The period of study was 18 months. The tools used were Hertel's exophthalmometer and visual evoked potential.

Result: The result of the present study was, increase in grades of proptosis, resulting in increased delay in PRVEP P-100 latency and decreased N70-P100 amplitude.

Conclusion: PRVEP is an important tool for the diagnosis of optic nerve involvement in proptosis.

Keywords: Exophthalmos, Exophthalmometer, Proptosis, Visual Evoked Potential (VEP).

INTRODUCTION

Proptosis is a forward movement of the globe in relation to the skull while the patient looks straight ahead¹. Forward protrusion of the eyeball beyond the orbital margins secondary to endocrinal dysfunction is called exophthalmos². Proptosis is measured as protrusion of the apex of the cornea from the lateral orbital margin. Normally, this distance in males is 17 mm, in females it is 16 mm and in children it is 14.5 mm³. For clinical purposes, the value in excess of 21 mm⁴ and the difference of 2 mm between two eyes³ is considered as proptosis. The incidence of proptosis in India is 0.037%.⁵ Incidence of proptosis among the pediatric population with orbital tumors is about 4.9%.⁶ About 38.3% patients with orbital diseases presented with proptosis.⁷ Among the patients with orbital tumours, 18% patients presented with proptosis.⁸ Graves' exophthalmos is the most common cause of proptosis in adults, occurring in 30 to 70% of patients with Graves' disease.^{9,10}

Proptosis secondary to a space-occupying process can result in a compressive optic neuropathy. Impeded optic nerve blood flow results in irreversible neuronal death and

diminished optic nerve functions.¹¹ VEP is an objective test to check optic nerve function.

Various studies have been carried out to explore the causes of proptosis, but very few studies have been done to evaluate VEP changes in proptosis. The observations of this study will further contribute to the proper diagnosis of proptosis and the use of VEP as an important tool for the diagnosis of optic nerve involvement in proptosis.

MATERIAL AND METHODS

This was a cross-sectional, hospital-based study including 40 patients with either unilateral or bilateral proptosis who fulfilled the inclusion and exclusion criteria and gave informed written consent.

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UP JOURNAL OF OPHTHALMOLOGY

An Official Journal of Uttar Pradesh State Ophthalmological Society,
UPSOS (Northern Ophthalmological Society, NOS)

p-ISSN: 2319-2062

DOI: 10.56692/upjo.2025130202

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How to cite this article: Verma S, Sundarkar T, Dhabarde A. Pattern Reversal Visual Evoked Potential (PRVEP) Changes in Patients with Proptosis. UP Journal of Ophthalmology. 2025;13(2): 48-50.

Received: 08-06-25, **Accepted:** 24-06-25, **Published:** 26-08-25

Inclusion Criteria

- Patients with proptosis.
- Patients with proptosis at any age.

Exclusion Criteria

- Patients with pseudoproptosis, i.e., those with high myopia, unilateral lid retraction, and enophthalmos of the contralateral eye.
- Patient not willing to participate in the study.

The period of study was 18 months from November 2018 to May 2020. The place of study was a rural-based tertiary care eye hospital. The tools used were Hertel's exophthalmometer and the visual evoked potential machine.

Measurements of proptosis were done using Hertel's Exophthalmometer, and accordingly, proptosis was graded as

- Mild (21–23 mm), Grade 1
- Moderate (24–27 mm), Grade 2
- Severe (28 mm or more), Grade 3.

VEP was recorded using a single machine under similar laboratory conditions in all patients. The procedure was explained to patients and verbal consent was taken. VEP was performed in a dark room. The patient was asked to sit 100 cm from the screen. The stimulus pattern was a black and white checkerboard. The pattern was reversed at the rate of 2 reversals/seconds. Patients were instructed to look at the red dot in the centre of the pattern. Each eye was tested separately. For performing the VEP test, standard disc EEG electrodes were used. The electrodes were placed at point Oz, Fz and a reference point according to ISCEV 2016.¹²

RESULTS

- Distribution of 40 patients (80 eyes) with either unilateral or bilateral proptosis based on grades of proptosis
 - Grade 1 Proptosis- 32 eyes (40%),
 - Grade 2 Proptosis- 22 eyes (27.50%),
 - Grade 3 Proptosis- 06 eyes (7.50%) &
 - No Proptosis- 20 eyes (25%).
- P100 latency increased with increasing grades of proptosis
 - Grade 1 Proptosis - 107.442 ± 6.0 ms,
 - Grade 2 Proptosis - 122.69 ± 13.18 ms and
 - Grade 3 Proptosis - 143.00 ± 7.33 ms
 - ($p = 0.0001$), Significant.
- N70-P100 amplitude decreased with increasing grades of proptosis

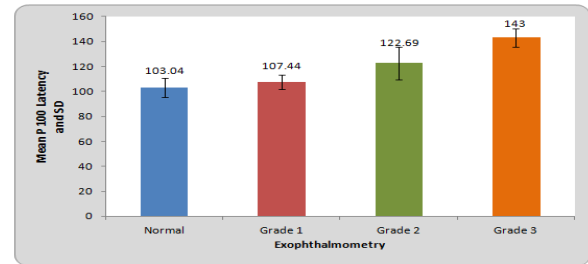


Figure 2: Graphical correlation of grades of proptosis with P100 latency

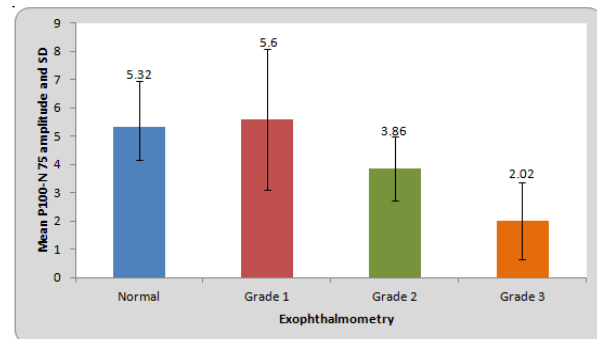


Figure 2: Graphical correlation of grades of proptosis with P100-N70 amplitude

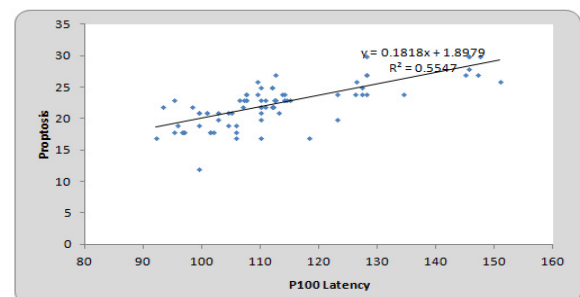


Figure 3: Correlation between P100 latency & proptosis

- Grade 1 Proptosis- 5.60 ± 2.5 mcV,
- Grade 2 Proptosis- 3.86 ± 1.13 mcV, and
- Grade 3 Proptosis- 2.02 ± 1.36 mcV
- ($p = 0.0001$), Significant.

Table 1: Correlation of grades of proptosis with P100 latency

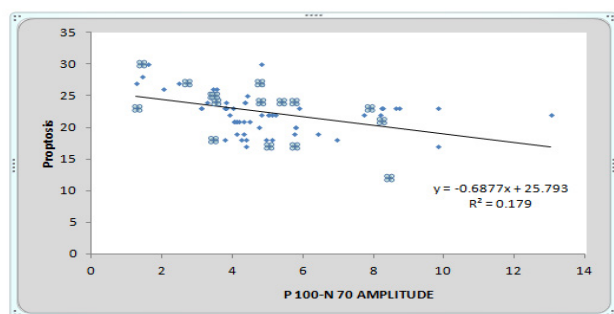
Grade	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Normal	20	103.04	7.76	1.73	99.40	106.67	92.00	123.10
Grade 1	32	107.44	6.00	1.06	105.27	109.60	93.10	115.00
Grade 2	22	122.69	13.18	2.81	116.84	128.53	107.50	151.00
Grade 3	6	143.00	7.33	2.99	135.29	150.70	128.10	147.50
Total	80	113.20	14.50	1.62	109.97	116.42	92.00	151.00
F-Value	42.76, p-value = 0.0001, Significant							

Table 2: Correlation of grades of proptosis with N 70-P100 amplitude

Grade	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Normal	20	5.32	1.62	0.36	4.56	6.08	3.46	9.81
Grade 1	32	5.60	2.50	0.44	4.70	6.50	1.30	13.03
Grade 2	22	3.86	1.13	0.24	3.36	4.37	1.25	5.76
Grade 3	6	2.02	1.36	0.55	0.58	3.45	1.43	4.81
Total	80	4.78	2.17	0.24	4.30	5.27	1.25	13.03
F-Value	8.28, p-value = 0.0001, Significant							

Table 3: Correlation between P100 latency, P100-N 70 amplitude and proptosis Pearson's correlation coefficient

Parameter	Mean	Std. deviation	Correlation 'r'	p-value
P100 latency	113.20	14.50	0.55	0.0001, S
P100-N7 Amplitude	4.78	2.17	0.68	0.0001, S

**Figure 4:** Correlation between P 100 latency and P 100-N 70 amplitude

CONCLUSION

An increase in grades of proptosis resulted in increased delay in PRVEP P-100 latency and decreased N70-P100 amplitude. Hence, PRVEP is an important tool for the diagnosis of optic nerve involvement in proptosis.

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