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NORMATIVE DATA OF OCULAR VESTIBULAR EVOKED MYOGENIC POTENTIALS

Sowmya Radhamani Venkataramanappa [1], Sathish Kumar Mallikarjuna [2*], Nirumal Khumar [3], Vinoth Kanna S [4] and Vasudevan Devanathan [5]

[1] Senior Resident, Department of Neurology Saveetha Medical College, Thandalam, Kanchipuram, Chennai, Tamil Nadu, India.
[2,3] Assistant Professor, Department of Neurology Saveetha Medical College, Thandalam, Kanchipuram, Chennai, Tamil Nadu, India.
[4] Professor, Department of Neurology Saveetha Medical College, Thandalam, Kanchipuram, Chennai, Tamil Nadu, India.
[5] Professor & HOD, Department of Neurology Saveetha Medical College, Thandalam, Kanchipuram Chennai, Tamil Nadu, India.
*Corresponding Author Email: sathish2806@gmail.com

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Abstract

Vestibular evoked myogenic potentials (VEMPs) are valuable tools for assessing otolithic function, particularly ocular VEMPs (oVEMPs), which reflect utricular function through the inferior oblique muscles. This study aimed to establish normative data for oVEMPs in a cohort of normal subjects and assess test-retest reliability. Thirty healthy adults under 45 years underwent oVEMP testing using recommended techniques. Results showed a 100% response rate in subjects under 45 years, with mean latencies of 10.35 ms (n10) and 15.30 ms (p16), and mean amplitudes of 7.90 μV. No significant gender or age-related differences were observed. These findings align with previous studies, indicating stable latencies across age groups. While some studies reported age-related latency increases, our results suggest stable latencies, supporting the reliability of oVEMPs as a diagnostic tool. Further studies with larger sample sizes are warranted to establish normative data across diverse populations and age groups.

Keywords: Vestibular Evoked Myogenic Potentials, oVEMPs, Normative Data, Test-Retest Reliability, Utricular Function, Age-Related Latency.

INTRODUCTION

Vestibular evoked myogenic potentials (VEMPs) are thought to arise from otolithic end organs. The cervical and extraocular muscles record VEMPs. These reflexes are triggered by air or bone pathways stimulating vestibular organs. Short bursts of loud air-conducted sound or bone-conducted skull vibration are utilized to activate these responses. Muscle activity is recorded using surface electrodes[1].

The extra ocular muscles provide the data for ocular VEMPs (oVEMPs). The contralateral utricle's otolithic function is reflected in the inferior oblique muscles[2,3]. By increasing the inferior oblique muscle contraction, the upward gaze enhances the amplitude of the response observed in oVEMP[4]. The 400–1,000 Hz range is where the best oVEMP responses are recorded. The ideal frequency range is still debatable[5-7]. These days, oVEMPs and cVEMPs are frequently utilized to evaluate otolith function in patients experiencing imbalance and vertigo. They are used to show loss of otolith function, i.e., in diseases like Meniere's disease (MD), vestibular neuritis (VN), vestibular schwannoma (VS), or stroke that cause damage to the inner ear, vestibular nerve, or central vestibular pathways. They are also frequently used to identify conditions like superior canal dehiscence (SCD) when there is an increase in otolith activation caused by sound and vibration.

Since latency prolongation can be another helpful test parameter, it can be noted that VEMPs, like other evoked potentials, are sensitive to slowing of conduction along the neuronal pathways. When evaluating latency delay, care should be taken since technical issues such electrode placement.

Abnormalities in the VEMP should be interpreted considering the possible false positive rate of each VEMP and semicircular canal function and hearing tests. The following describes the usual patterns of abnormalities seen in common neuro-otological diseases[8]

Aims And Objective

The aim of the current investigation was to elucidate further the normal features of the ocular VEMP in a cohort of age-stratified normal subjects and to assess the test–retest authenticity of the oVEMP using common recommended stimulus and recording techniques.

METHODOLOGY AND RECORDING PROCEDURE

Ocular VEMP study was conducted for 30 normal adult volunteers using Natus Nerve conduction machine with evoked potential (EP) and electromyography (EMG) in department of Neurology from 2022-2023 at Saveetha Medical College and Hospital outpatients after obtaining the clearance and approval from the institutional ethics committee.

Inclusion Criterion

Healthy volunteers of age less than 45 years without auditory and vestibular dysfunction.

Exclusion Criterion

Volunteers more than 45 years.

Patients with hearing defects and vestibular dysfunction

The participants were asked to maintain an upward gaze of roughly thirty degrees on a pre-marked visual target while sitting erect. The active electrode was placed below the lower lid margin of the contralateral eye, the reference electrode above the eyebrow, and the ground at the forehead. The acoustic stimulus (click 5Hz, 95dB SPL, rate 5.0/sec, rise/fall: 1ms, plateau: 2ms), was delivered using headphones. The EMG signal was amplified 5000x and band pass filtered 1-1000Hz

The resulting EMP trace is a biphasic waveform. N1 and P1, the first and second peaks, have respective mean latency of ~10 and 15 milliseconds for their negative deflection (N) and positive peak (P), respectively. For repeatable and trustworthy results, control over muscle contraction is essential as surface electromyography records responses.[9-11]

OBSERVATIONS AND RESULTS

The ocular vestibular evoked myogenic potential test was done in 30 normal adults population. Among 30 normal adults 15 were male and 15 were female adults.

The data was analyzed using SPSS statistics.

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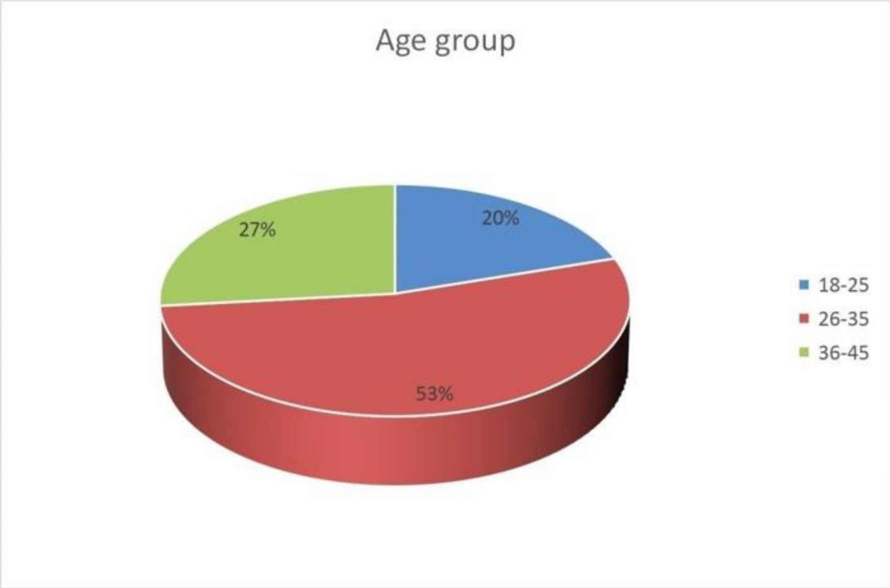
Table 1: The Patients were Classified According to their Age as three Categories

AGE GROUP	NOS	PERCENTAGE
18-25	6	20%
26-35	16	53.33%
36-45	8	26.67%



The Ocular VEMP test was done for 30 patients, p-16 and n-10 for 95 db latencies were noted from both right and left sides.

Table 2: P-16 latency distribution of both sides

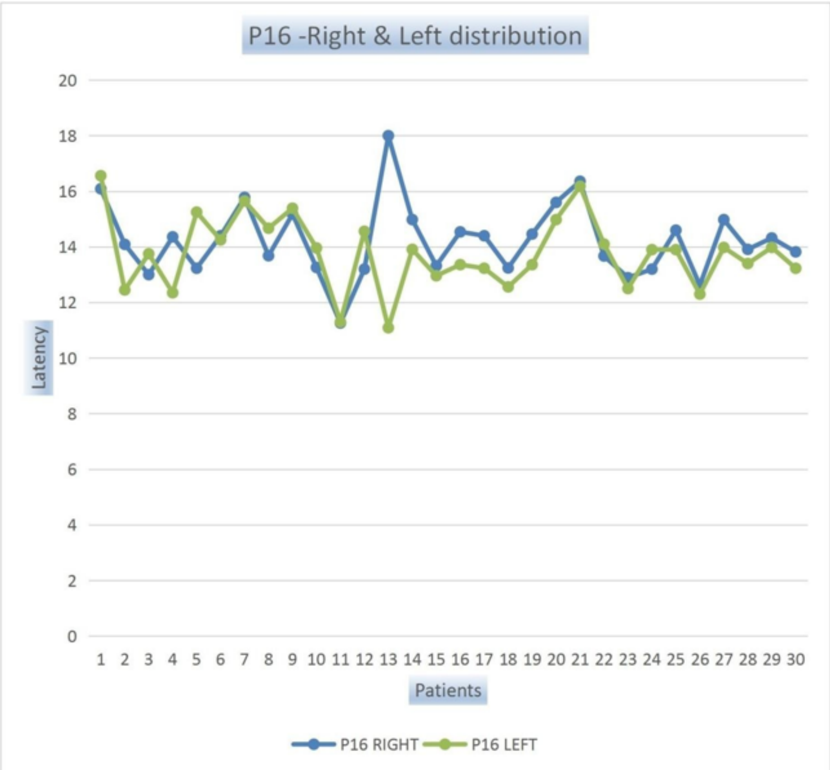


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Table 3: N-10 Latency Distribution of Both Sides

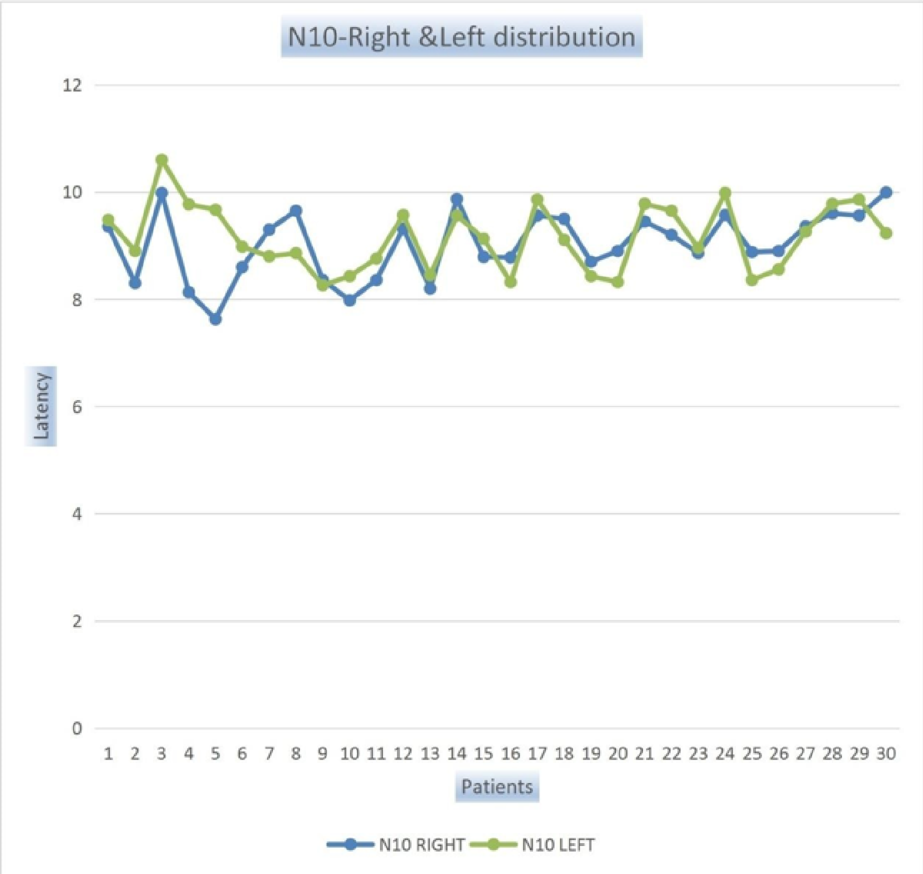
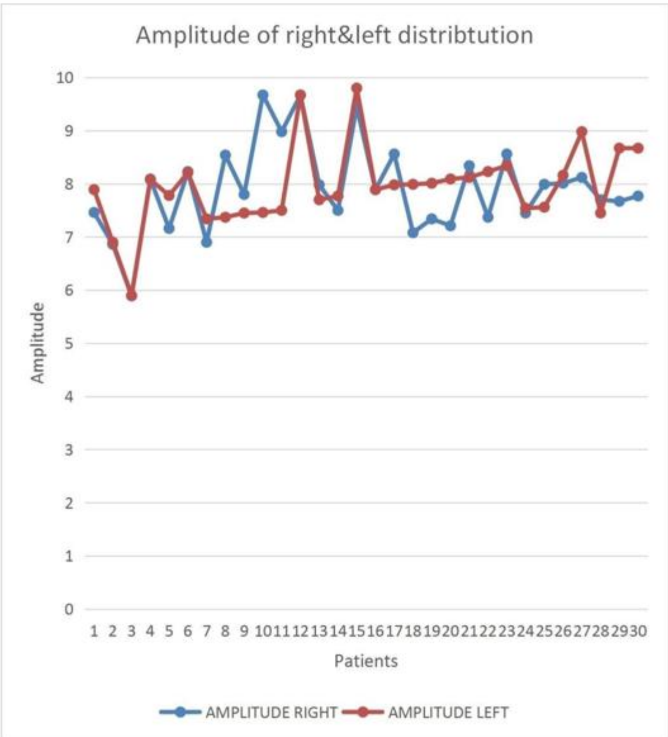


Table 4: N-10 and P-16 amplitude for 95 db Distribution of Both Sides



Mean and Standard Deviation Distribution of Obtained Latencies and Amplitude.

		MEAN	SD
Latency	Rt P16	15.296	1.300
	Lt P16	15.102	1.236
	Rt N10	10.054	0.707
	Lt N10	10.019	1.122
Amplitude	RIGHT	7.908	0.8431
	LEFT	7.95	0.749

DISCUSSION

The study was performed to arrive at normative data at our institute. When we examined our younger cohort, we also found a 100% response rate for subjects under the age of 45. The mean n10 latency value in the current study was 10.35 ± 1.02m s and for p16 latency was 15.30±1.20ms. The mean amplitudes were 7.90±1.10μV. The latencies did not show any significant differences between female and male volunteers did not show any significant difference among the 3 age groups.

Chiharaet al (2007) reported as 90% oVEMP response rate with a sample of only 10 subjects, all under the age of 60 yr[12]. Others have reported 100% response rates, though each of these studies was limited to a small number of subjects, all less than 35 yr of age (Todd et al, 2007; Chou et al, 2009; Hsu et al, 2009).

In the current study, an age effect on the amplitude and the threshold of the oVEMP response was not observed. Latency was stable for all age groups, as were inter aural latency differences.

Many of the recent studies have too analyzed the implications of age on the oVEMP response (Iwasaki et al, 2008a, 2008b; Nguyen et al, 2010; Tseng et al, 2010)[13-15]. Both Iwasaki et al [15] and Tseng, Chou, and Young[14] recorded oVEMPs in response to bone-conducted vibration stimuli, and Nguyen, Welgampola, and Carey[13](2010) recorded oVEMPs in response to air-conducted clicks, air-conducted 500 Hz tone bursts, and vibratory stimuli for 53 subjects ranging from young early twenties to elderly adults i.e., late eighties. Both our study and that of Nguyen, Welgampola, and Carey (2010) found that age did not affect oVEMP latencies[13]. In contrast, Iwasaki et al (2008b) which included 67 volunteers from ages ranging 20 to 83 and Tseng, Chou, and Young (2010) which included 70 individuals from 24 to 76 years reported a significant increase in n10 latency with increasing age. Swamy et al study included 120 healthy volunteers between 18 to 55 years which is an Indian study had recordable o VEMP. There was no remarkable difference between left and right ear stimulation. 16

CONCLUSION

In conclusion, our findings suggest that the oVEMP is a reliable diagnostic tool that may be best recorded using an infra orbital-to-above the eyebrow electrode montage. The oVEMP is well tolerated and is simple to administer.

The limitations of current study include smaller sample size, and that patients older than 45 were not included. Hence larger studies are required to establish the normative data in south indian populations across various age groups.

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