International Journal of Speech and Audiology

E-ISSN: 2710-3854
P-ISSN: 2710-3846
Impact Factor (RJIF): 6.4
IJSA 2026; 7(1): 05-15

Journal's Website
Received: 04-11-2025
Accepted: 06-12-2025

Geeta Prasad Sahu
Senior Audiologist CUM Speech language pathologist State institute for Empowerment of person with disability (SIEP), SSEPD Department, Government of Odisha, India

Dr. Pampa De
MBBS, DNB IN PMR Superintendent, State institute for Empowerment of person with disability (SIEP), SSEPD Department, Government of Odisha, India

Bhaskar Dey
Consultant Speech- language pathologist, AYJ-NISHD, RC, Kolkata, West Bengal, India

Dr. Suman Narayan Swamy
Vice principal & Associate Professor in Audiology, Samvaad Institute of speech and Hearing, Bengaluru, Karnataka, India

Simantinee Chakraborty
Consultant Audiologist, Meenakshi ENT Specialty Hospital, Bengaluru, Karnataka, India

Chandraprabha Dutta
Senior Consultant Speech-Language Pathologist, Harmony Child Speech Development Clinic, Bhubaneswar, Odisha, India; Consultant Speech-Language Pathologist, Hima Hospital, Keonjhar, Odisha, India

Correspondence
Geeta Prasad Sahu
Senior Audiologist CUM Speech language pathologist State institute for Empowerment of person with disability (SIEP), SSEPD Department, Government of Odisha, India

Effect of aging in Indian population: Compartative study of latency shifting using o VEMP

Geeta Prasad Sahu, Dr. Pampa De, Bhaskar Dey, Dr. Suman Narayan Swamy, Simantinee Chakraborty and Chandraprabha Dutta

DOI: https://www.doi.org/10.22271/27103846.2026.v7.i1a.98

Abstract
Aim: The aim of the present study is to compare the latency shifting in aging by using oVEMP in Indian population within the age range of 20-80yrs.
Method: Sixty participants aged 20-80 were tested for ocular vestibular evoked myogenic potentials (oVEMP) using a VEMP system. Electrodes were placed on the inferior oblique muscles, and auditory stimuli were administered to assess muscle responses. Ocular vestibular evoked myogenic potentials (oVEMP) are diagnostic tests that assess the function of the vestibular system. This test can be conducted using an instrument called a VEMP (vestibular evoked myogenic potential) system. Here's how oVEMP tests are typically performed using a VEMP system: The patient is positioned comfortably in a reclined chair or on an examination table. Surface electrodes are placed on specific muscles, the inferior oblique (IO) muscle for oVEMP. The patient is instructed to relax and keep their head still during the test. In positioning for VEMP tests, the highest response rates were achieved when subjects were in a sitting position for oVEMP.
Results: This study shows that normal individuals of age over 60 have the latencies of oVEMP (n10 and p15) are longer than in younger adults.
Conclusion: It was concluded that in individuals of age over 60 have oVEMP (n10 and p15) are longer than in young adults, indicating age-related vestibular changes. These tests, using a VEMP system, assess muscle responses from IO muscles, aiding in vestibular function evaluation and disorder detection.

Keywords: oVEMP, inferior oblique muscle, Utriculo-Saculo reflex pathway

Introduction

The natural aging process may result in morphological changes in the vestibular system and in the afferent neural pathways, including loss of hair cells decreased numbers of vestibular nerve cells, and loss of neurons in the vestibular nucleus. Thus, with advancing age, there should be decrease in amplitudes and increase in latencies of the vestibular evoked myogenic potentials, especially the prolongation of n10& p15latency. When an acoustic stimulus of sufficiently high intensity is presented to an ear, a series of reflexes are triggered that include short latency sound-evoked activations, and, sound-evoked inhibitions, of electromyographic (EMG) activity. These sound evoked muscle reflexes can be easily recorded with surface electrodes placed in proximity to the inferior oblique muscle (IO).

The vestibular evoked myogenic potentials (VEMP) are a short-latency myogenic potential evoked by air conduction sound, bone conduction, vibration, and /or the electrical stimulation. When the myogenic response is recorded from inferior oblique muscle, it is known as ocular (oVEMP). oVEMP the functions of Utriculo-Saculo reflex.

Ocular Vestibular Evoked Myogenic Potentials

Vestibular evoked myogenic potential (VEMP) is a sonomotor response triggered by loud acoustic, vibratory, or galvanic stimuli. Ocular VEMP (oVEMP), recorded below the eyes, shows a biphasic waveform with peaks at 10 ms and 15 ms. However, more recent research supports the utricle as the generator organ. Once generated in the utricle, the impulses travel along the superior vestibular nerve, vestibular nuclei, medial longitudinal fasciculus and cross-over to contralateral oculomotor nuclei to end-up in the inferior oblique muscle.

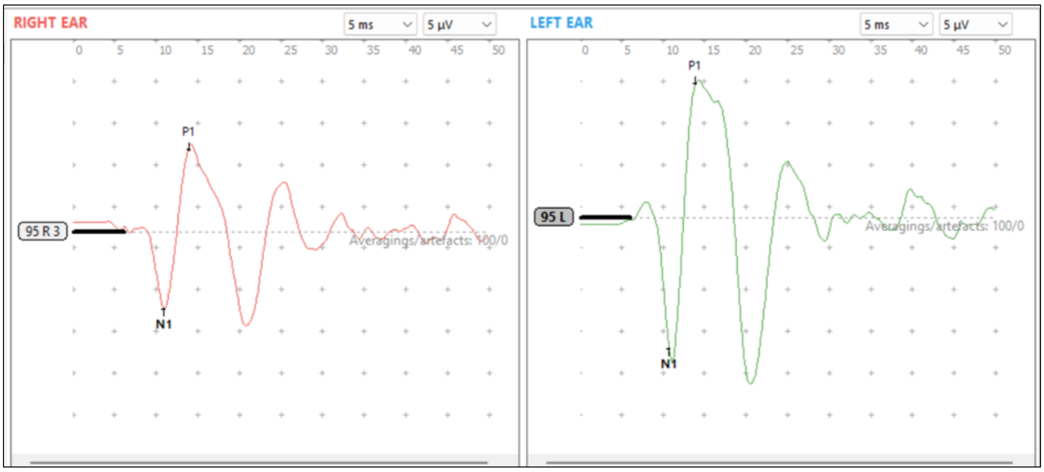


Fig 1: Typical oVEMP waveforms n10 and p15 obtained from right and left ears of an individual with no vestibular deficits.

Utriculo-Saculo reflex pathway

oVEMP reflects the utriculo-saccular reflex. When sound is delivered through insert earphones, both the utricle and saccule are simultaneously stimulated, causing them to vibrate. These mechanical vibrations are converted into neural signals, which travel via the superior vestibular nerve to the vestibular nucleus. The signal then ascends through the medial longitudinal fasciculus, projecting to the abducens and trochlear nuclei. Due to decussation, the response ultimately activates the contralateral inferior oblique muscle, where oVEMP is recorded.

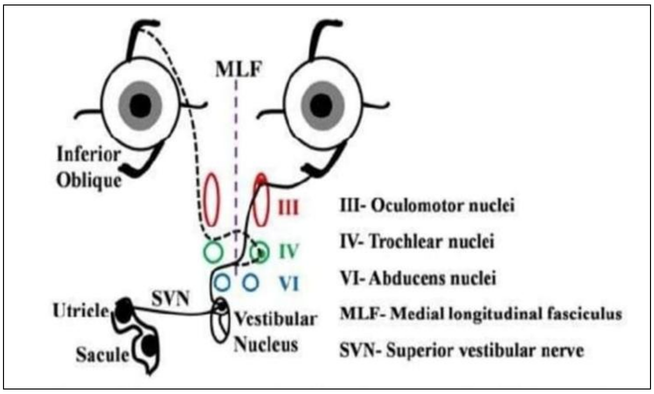


Fig 2: Schematic representation of the pathways involved in oVEMP generation.

Methodology

1 Aim of the Study

The aim of the present study is to compare the latency shifting in aging by using oVEMP in Indian population within the age range of 20-80yrs.

2 Objectives

Latency shifting in Indian population with age range of 20-80yrs by oVEMP.

3 Participant

Sixty participants were included from karnataka geographical region in between the age range of 20-80yrs who were normal.

Between December 2023 and November 2024, 60 participants, most had hearing thresholds below 25dB nHL at Key frequencies, including 500Hz, 1KHz and 2 KHz, indicating normal or near - normal hearing were tested in our department. In this research 25 females and 35 males under the range of 20 to 80 year (MEAN=45.98, SD=18.21) have been taken. No participants with previous treatment of affecting vestibular function, such as vestibular suppressants or ototoxic drugs, and chronic conditions like diabetes, hypertension or autoimmune diseases were included in survey.

Study Identification, Selection, Inclusion

The article procedure followed the inclusion and exclusion criteria, as mentioned below:

Inclusion Criteria

The study included participants aged 20-80 years, most with hearing thresholds below 25 dB nHL at 500 Hz, 1 kHz, and 2 kHz, indicating normal or near-normal hearing. All demonstrated Type A tympanograms, reflecting normal middle ear function with healthy tympanic membrane mobility and pressure. Ipsilateral and contralateral acoustic reflexes were present, confirming intact auditory pathways. These selection criteria ensured normal auditory and middle ear function, thereby minimizing the influence of auditory factors on vestibular test outcomes.

Exclusion Criteria

Individuals with significant head trauma, stroke, ear surgery, or hearing loss (average threshold >25 dB HL) were excluded, as these may alter vestibular evoked myogenic potential (VEMP) responses. Those taking vestibular suppressants, ototoxic drugs, or with chronic conditions such as diabetes mellitus, hypertension, or autoimmune diseases were also excluded due to their potential impact on vestibular function. Participants with balance issues or relevant comorbidities were omitted to ensure accurate assessment of normal vestibular function and reliability of study findings.

Procedures

Ocular vestibular evoked myogenic potentials (oVEMP) are diagnostic tests that assess the function of the vestibular system. These tests can be conducted using an instrument called a VEMP (vestibular evoked myogenic potential) system. Here's how oVEMP tests are typically performed using a VEMP system: The patient is positioned comfortably in a reclined chair or on an examination table. Surface electrodes are placed on specific muscles, typically the inferior oblique (IO) muscle for oVEMP. The patient is instructed to relax and keep their head still during the test. In positioning for VEMP tests, the highest response rates were achieved when subjects were in a sitting position for oVEMP.

Audiological Data

To conduct this study, a pure-tone audiometry test that included 10 frequencies (125 Hz, 250 Hz, 500 Hz, 1KHz,1.5 KHz, 2KHz, 4 KHz, 6KHz and 8KHz), Tympanometry & Reflexometry test and o VEMP test had to be conducted in which the normal range was considered in this study.

Audiological Equipment Used

In this study mainly (Interacoustics AD232, Triveni) Audiometer was used for pure- tone audiometer test and (Otowave 202, Ineracoustic AT235, Path medical) Immittance meter was used for tympanometry& reflexometric test and (Neuro soft) was used for oVEMP test.

VEMP Test Protocols and Parameters

The VEMP system administers a series of auditory stimuli, typically in the form of tone bursts, through headphones worn by the patient.

(a) The system records muscle responses from the IO muscle in response to the auditory stimuli.
(b) The examiner monitors the EMG activity of the IO muscle to assess the presence and characteristics of the oVEMP response.
(c) The oVEMP response typically consists of a biphasic waveform, with a negative peak at around 8-12 ms (n10) and a positive peak at around 13-17 ms (p15).

Electrode Placement

Electrode placement is vital to recording of all potentials, more so for muscle potentials. This was proved by a study using 6 different electrode positions around the ipsilateral and contralateral eye shown in Figure 3. Contralateral belly-tendon placement of electrodes (inverting electrode paced below non-inverting) produced the largest oVEMP amplitudes among the six. This current studies showed that electrodes placed directly below the contralateral eye (noninverting 1 cm below the lower eye lid, inverting 2 cm below the non-inverting and ground on the forehead) are best for high amplitude recording of oVEMP clinically.

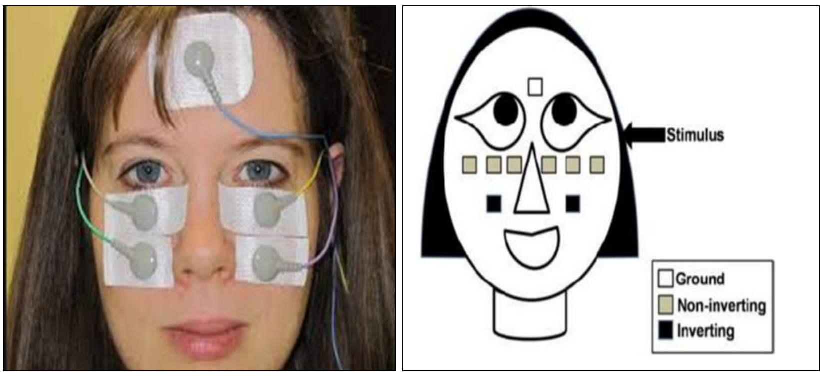


Fig 3: Schematic diagram showing various electrode placements used in studies exploring electrode placement on oVEMP.

Protocol for recording oVEMP

Table 1: Depicts protocol for oVEMP recording.

Stimulius parameters	
Type of stimuli	Tone burst
Stimulus Frequency	500 Hz (Depends on purpose)
Stimulus duration	2-1-2 cycle (100usec)
Intensity	95 dBnHL
Repetition rate	5.1/sec
Polarity	Rarefaction/ Alternating
Total number of sweeps	150- 200
Acquisition Parameters	
Analysis Time	64 msec including 10 msec pre stimulus
Filter Setting	High pass: 1-10Hz Low pass: 500-1000Hz
Notch Filter	On
Amplification	3000 to 5000
Number of recordings	2(Ipsilateral and Contralateral Midline response)
Transducer	Insert ear phone (ER-3A)
Platue	1ms
Gating	Black man
Rise /fall	2ms
Latency	n10(8-12) ms, p15(13-17) ms

Jacobson,G.P,Shepard,N.T,Barin,K,Burkad,R.F&Jankey,K.Sinha,Singh(2020).Balancefunction Assessment (3rd ed.). Plural pub Inc.

Interpretation

The VEMP system analyzes the latency and amplitude of the oVEMP responses. Abnormalities in the latency or amplitude of the oVEMP responses may indicate dysfunction in the otolithic organs or Utriculo-Saculo reflex pathway. Normal results show short, consistent latencies for oVEMP (n10, p15) wave components, indicating proper neural conduction and reflex pathways. Normal VEMP responses suggest healthy vestibular function, critical for balance and spatial orientation, and help rule out vestibular dysfunction or nerve impairment. The results are typically interpreted by a healthcare professional experienced in vestibular testing and vestibular disorders.

Statistical analysis

The collected data were summarized by using the Descriptive Statistics: frequency, percentage; mean and S.D. The Independent sample "t" test was used to compare o VEMP amplitude according to age groups as well as gender. The Paired "t" test was used to compare o VEMP amplitude between right ear and left ear as well as positive and negative. The One sample "t" test was used to compare o VEMP amplitude according to its normal value. To find the relation between o VEMP amplitude; the Pearson correlation coefficient ("r") was used. The p value < 0.05 was considered as significant. Data were analyzed by using the SPSS software (SPSS Inc.; Chicago, IL) version 29.0.10.

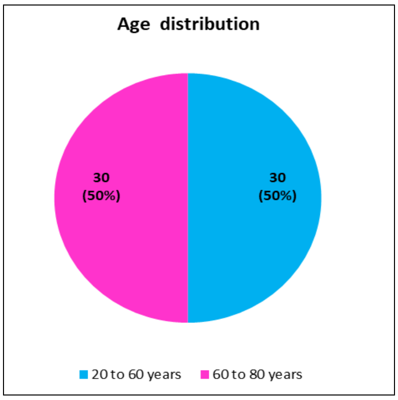
Results

In This present study participants were included from karnataka geographical region in between the age range of 20-80 yrs who were normal.

Table 1: Descriptive Statistics for age

(n=60)	Range	Mean	S.D.
Age (Years)	20 to 78	45.98	18.21

Note: - n = total number of populations

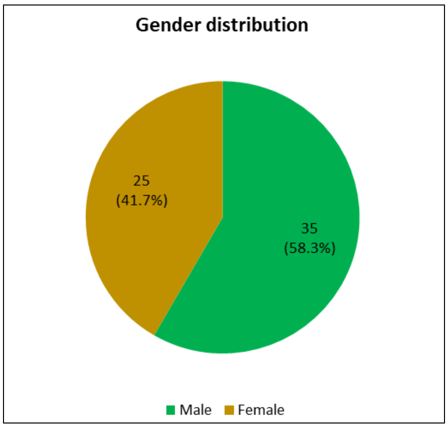


Graph 1(a): Represents the age range distribution in younger and older adults

Table 1, Graph 1(a) shows the descriptive statistical analysis of mean (M) (45.98 years) The average age of the participants is approximately 46 years. This is the central point around which the ages are distributed. The youngest person in the group is 20 years old, and the oldest is 78 years old. This indicates a wide variation in age among the participants. The standard deviation measures how spread out the ages are from the mean. A standard deviation of 18.21 years indicates that the ages of most participants tend to vary by about 18 years above or below the average age. These statistics together provide an overview of the age distribution, highlighting the average age, the range of ages, and how much variation exists around the average age. As mentioned in the present study there was a significant main effect of age group and frequency on the amplitude of the oVEMP. The latency of oVEMP n10 and p15 wave component are longer in the elderly aged >60 years than in young adults.

Table 2: Descriptive statistics of age groups and gender

		Frequency	%
Age groups	20 to 60 years	30	50
	60 to 80 years	30	50
Gender	Male	35	58.3
	Female	25	41.7

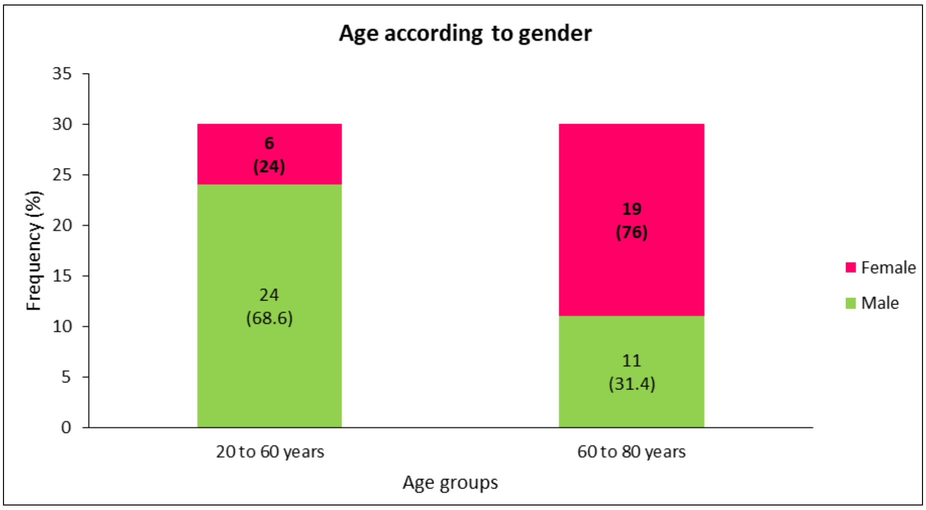


Graph 2(a): Represents the gender distribution of male and female

Table 2 Graph 2(a) shows the descriptive statical analysis frequency value obtained for both male and females along with normal individuals. There was total 60 individuals with normal individuals which includes 35 males and 25 females. As seen in Table 2 from all the 35 participants (58.3%) were males and 25 participants (41.7%) were females. Table 2 shows that the distribution of age groups 20 to 60 years: There are 30 individuals in this age group, making up 50% of the total population. 60 to 80 years: Similarly, this age group also has 30 individuals, representing the remaining 50% of the population. The population is evenly split between the two age groups, with half of the participants being younger adults (20 to 60 years) and the other half being older adults (60 to 80 years).

Table 3: Descriptive statistics of Age according to gender

		Gender			
		Male		Female	
		n	%	N	%
Age groups	20 to 60 years	24	68.6	6	24
	60 to 80 years	11	31.4	19	76



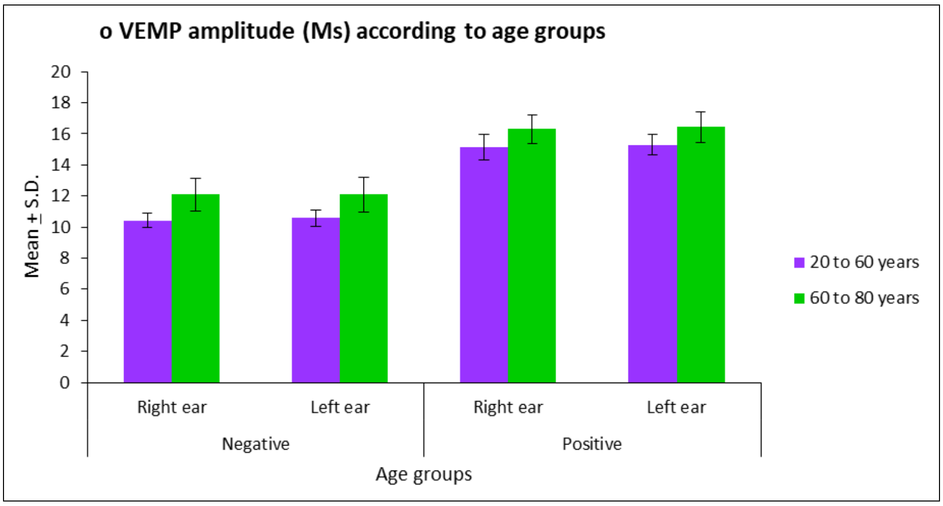
Graph 3(a): Represents the distribution of age according to gender

Table 3, Graph 3(a) shows the data presents the distribution of participants across different age groups and genders. Among individuals aged 20 to 60 years, there were 24 males, accounting for 68.6% of this age group, while females comprised 24% with 6 participants. In the older age group of 60 to 80 years, the gender distribution shifts significantly. Here, males made up 31.4% with 11 participants, whereas females constituted the majority with 76%, totalling 19 participants. This suggests a higher representation of females in the older age group, while males are more prevalent in the younger age group.

Table 4: Comparison of o VEMP amplitude according to age groups

			Age groups				**"t"**	**p value**
			20 to 60 years		**60 to 80 years**			
			Mean	**S.D.**	**Mean**	**S.D.**		
o VEMP amplitude (Ms)	Negative	Right ear	10.43	0.48	12.09	1.06	-7.83	< 0.001*
		Left ear	10.57	0.52	12.08	1.13	-6.65	< 0.001*
	Positive	Right ear	15.17	0.82	16.30	0.92	-4.99	< 0.001*
		Left ear	15.30	0.66	16.43	1.01	-5.10	< 0.001*

Note: (S.D = Standard Deviation, "t" = Independent sample "t" test; * Significant)



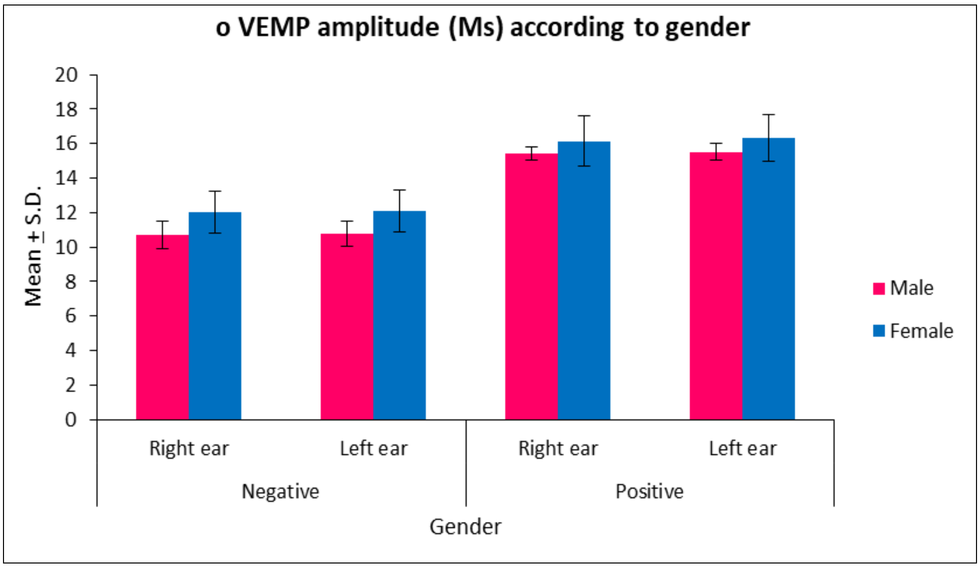
Graph 4(a): Represents the Comparison of o VEMP amplitude (Ms) according to age groups

Table 4 and Graph 4(a) present the parametric statistical analysis using an independent sample t-test to compare oVEMP amplitudes across age groups. The results showed significantly prolonged mean n1 and p1 latencies in older adults (60-80 years) compared to young adults (20-60 years) for both ears. Additionally, oVEMP amplitudes demonstrated significantly higher mean values in the older group across both positive and negative responses, with all p-values < 0.001, indicating age-related changes in vestibular evoked myogenic potentials.

Table 5: Comparison of o VEMP amplitude according to gender

			Gender				"t"	p value
			Male		Female			
			Mean	S.D.	Mean	S.D.		
o VEMP amplitude (Ms)	Negative	Right ear	10.72	0.79	12.02	1.21	-5.06	< 0.001*
		Left ear	10.78	0.73	12.09	1.22	-5.18	< 0.001*
	Positive	Right ear	15.44	0.40	16.15	1.45	-2.80	0.007*
		Left ear	15.52	0.48	16.35	1.35	-3.38	0.001*

Note: (S.D = Standard Deviation, "t" = Independent sample "t" test; * Significant)



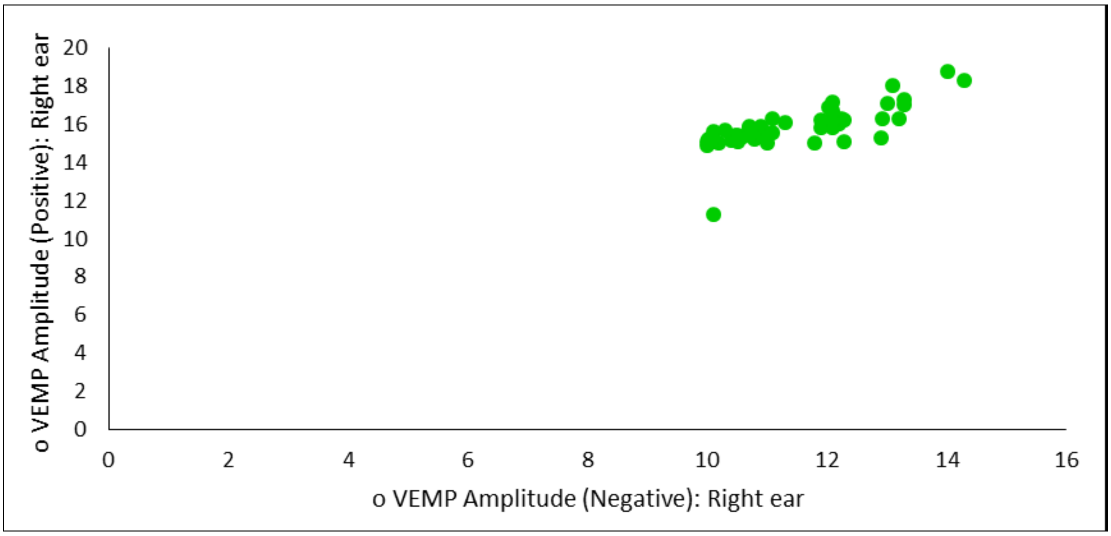
Graph 5(a): Represents the Comparison of o VEMP amplitude (Ms) according to gender

Table 5 and Graph 5(a) present a comparison of oVEMP amplitudes between male and female participants for both ears. Mean amplitude values with standard deviations, along with t-values and p-values, demonstrate statistically significant gender differences. Females exhibited significantly higher oVEMP amplitudes than males for both positive and negative waveforms in the right and left ears. All comparisons yielded p-values less than 0.05, indicating that gender has a significant influence on oVEMP amplitudes, with females consistently showing higher responses.

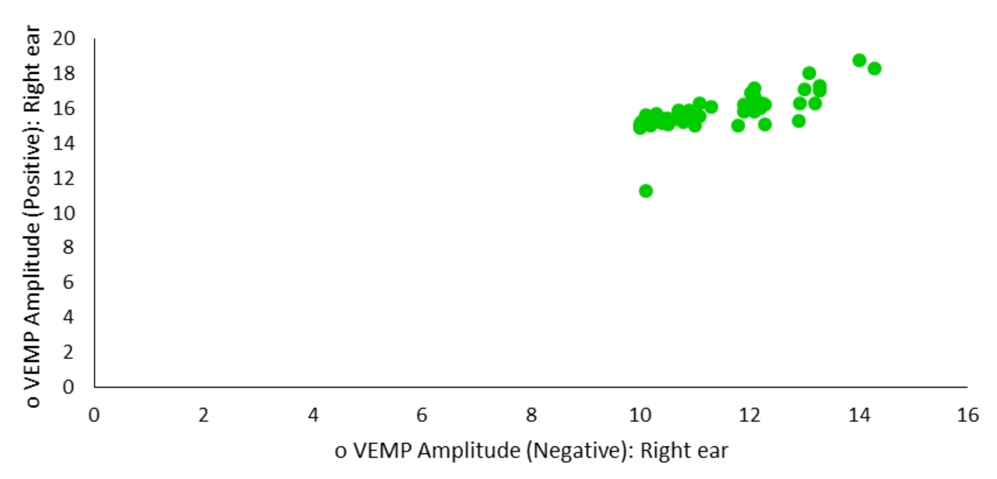
Table 6: Comparison of o VEMP amplitude between right ear and left ear

		Right ear		Left ear		"t"	p value
		Mean	S.D.	Mean	S.D.		
oVEMP amplitude (Ms)	Negative	11.26	1.17	11.33	1.16	-0.80	0.425
	Positive	15.74	1.04	15.87	1.02	-2.30	0.025*

(S.D = Standard Deviation, "t" = Paired "t" test; * Significant)



Graph 6(a): Represents the correlation between o VEMP Amplitude (Negative): Right ear and o VEMP Amplitude (Positive): Right ear



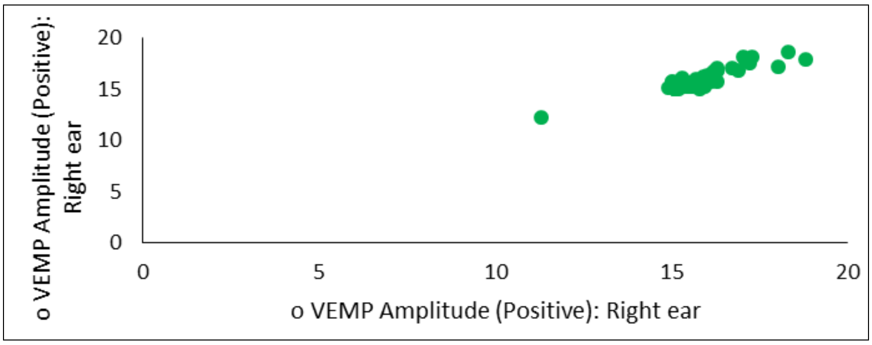
Graph 6 (b): Represents the correlation between o VEMP Amplitude (Negative): Left ear and o VEMP Amplitude (Positive): Left ear

Table 6 and Graph 6 (a)and (b)compares oVEMP amplitudes between the right and left ears using paired t-test analysis. No significant difference was observed for negative oVEMP amplitudes, with mean values of 11.26 ms in the right ear and 11.33 ms in the left ear (p = 0.425). In contrast, positive oVEMP amplitudes showed a statistically significant interaural difference, with higher mean amplitude in the left ear (15.87 ms) compared to the right ear (15.74 ms) (p = 0.025), indicating a meaningful asymmetry.

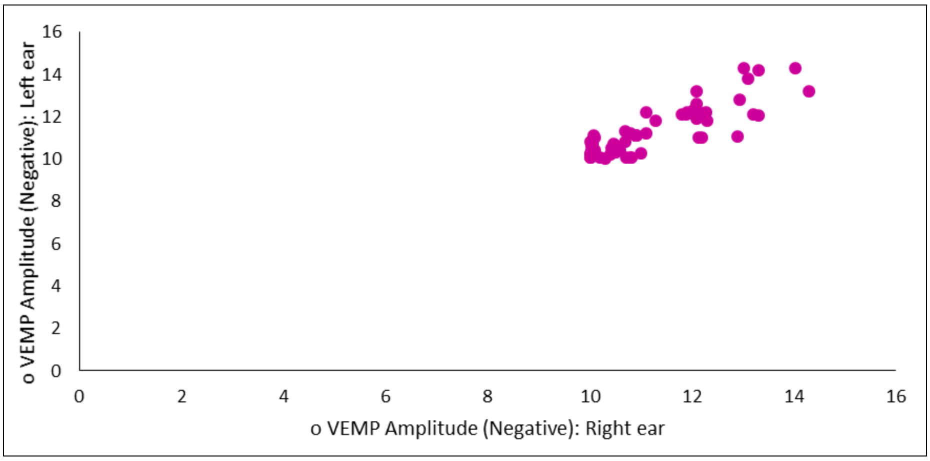
Table 7: Comparison of o VEMP amplitude between positive and negative

		Positive		Negative		"t"	p value
		Mean	**S.D.**	**Mean**	**S.D.**		
o VEMP amplitude	Right ear	15.74	1.04	11.26	1.17	43.59	< 0.001*
	Left ear	15.87	1.02	11.33	1.16	42.77	< 0.001*

(S.D = Standard Deviation, "t" = Paired "t" test; * Significant)



Graph 7(a): Represents the correlation between o VEMP Amplitude (Positive): Right ear and o VEMP Amplitude (Positive): Left ear



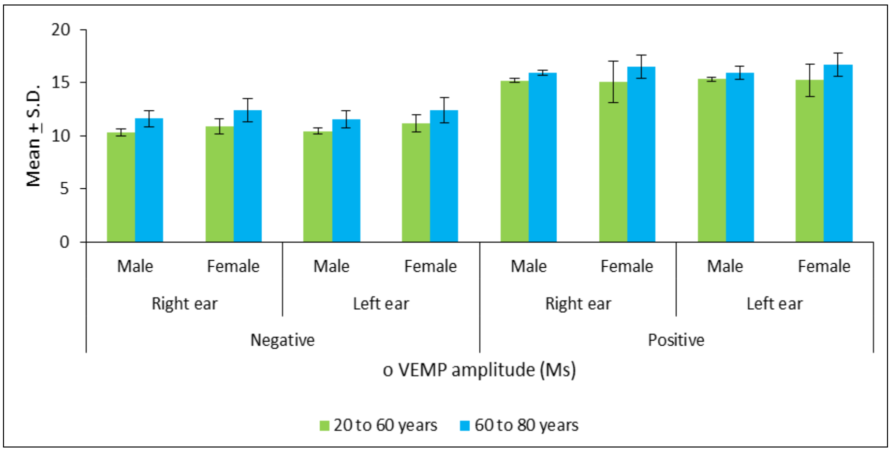
Graph 7(b): Represents the correlation between o VEMP Amplitude (Negative): Right ear and o VEMP Amplitude (Negative): Left ear

Table 7 and Graphs 7 (a) and 7(b) compare oVEMP amplitudes between positive and negative groups. A statistically significant difference ($p<0.05$) was observed in oVEMP amplitudes for both ears. In the right ear, the positive group showed a higher mean amplitude (15.74±1.04) compared to the negative group (11.26±1.17), with a t-value of 43.59 ($p<0.001$). Similarly, left ear amplitudes were significantly higher in the positive group (15.87±1.02) than the negative group (11.33±1.16), with a t-value of 42.77 ($p<0.001$).

Table 8: Comparison of o VEMP amplitude between the age groups according to gender

		Age groups	Male				Female			
			Mean	**S.D.**	**"t"**	**p value**	**Mean**	**S.D.**	**"t"**	**p value**
oVEMP amplitude (Negative)	Right ear	20 to 60 years	10.31	0.32	-6.90	< 0.001*	10.89	0.74	-3.06	0.006*
		60 to 80 years	11.60	0.80			12.38	1.11		
	Left ear	20 to 60 years	10.43	0.30	-6.07	< 0.001*	11.15	0.80	-2.35	0.028*
		60 to 80 years	11.56	0.81			12.39	1.20		
oVEMP amplitude (Positive)	Right ear	20 to 60 years	15.21	0.16	-9.77	< 0.001*	15.04	1.95	-2.37	0.026*
		60 to 80 years	15.93	0.28			16.51	1.09		
	Left ear	20 to 60 years	15.32	0.22	-4.38	< 0.001*	15.22	1.53	-2.65	0.014*

(S.D = Standard Deviation, "t" = Independent sample "t" test; * Significant)



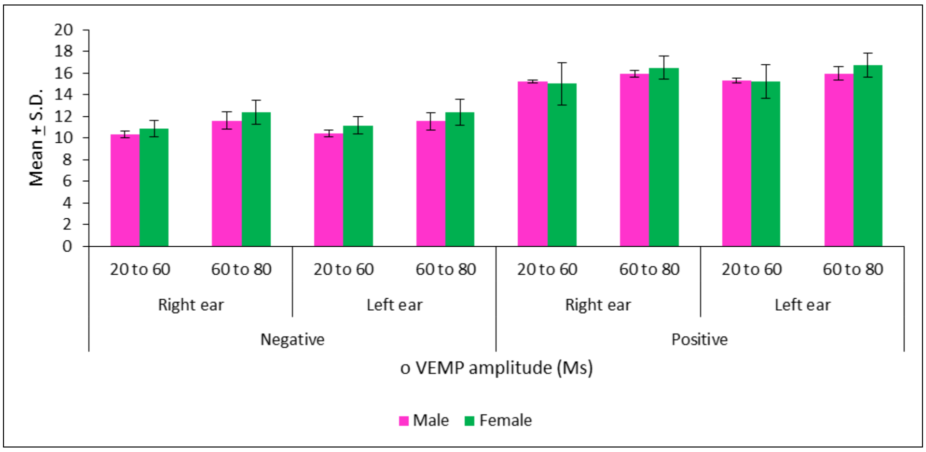
Graph 8(a): Represents the Comparison of o VEMP amplitude (Ms) according to age groups with in gender

Table 8, Graph 8(a) shows the oVEMP Amplitude Negative group the older group (60 to 80 years) has higher amplitudes in both ears for males and females, and the difference is statistically significant across all comparisons ($p<0.05$). The right ear in males shows the most substantial difference ($p<0.001$). Similarly Positive group shows that the older group has higher amplitudes than the younger group, with significant differences in both ears for both genders ($p<0.05$), especially for males. This study shows that older age (60-80 years) is consistently associated with higher amplitudes in oVEMP, across genders and test conditions (positive/negative). The differences suggest that age impacts vestibular function, with older individuals generally showing higher VEMP amplitudes than younger ones.

Table 9: Comparison of o VEMP amplitude between males and females according to the age groups.

		Gender	20 to 60 years				60 to 80 years			
			Mean	S.D.	"t"	p value	Mean	S.D.	"t"	p value
o VEMP amplitude (Negative)	Right ear	Male	10.31	0.32	-2.96	0.006*	11.60	0.80	-2.04	0.051
		Female	10.89	0.74			12.38	1.11		
	Left ear	Male	10.43	0.30	-3.67	0.001*	11.56	0.81	-2.05	0.050*
		Female	11.15	0.80			12.39	1.20		
o VEMP amplitude (Positive)	Right ear	Male	15.21	0.16	0.45	0.655	15.93	0.28	-1.70	0.099
		Female	15.04	1.95			16.51	1.09		
	Left ear	Male	15.32	0.22	0.35	0.729	15.94	0.62	-2.11	0.044*
		Female	15.22	1.53			16.71	1.10		

(S.D = Standard Deviation, "t" = Independent sample "t" test; * Significant)



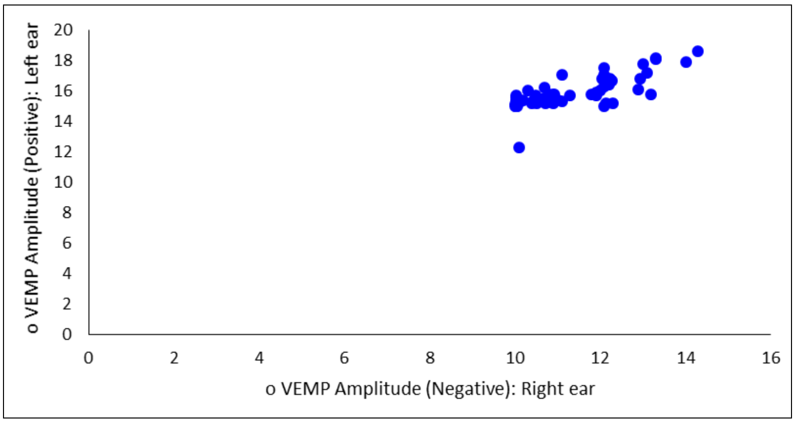
Graph 9(a): Represents the Comparison of oVEMP amplitude (Ms) according to gender with in the age groups

Table 9 and Graph 9(a) compare oVEMP amplitudes between males and females across two age groups (20-60 years and 60-80 years). Females showed significantly higher oVEMP amplitudes than males in the younger group for both ears, with statistically significant differences in the right ear (p = 0.006) and left ear (p = 0.001), particularly for negative amplitudes. In the older group, females also demonstrated higher amplitudes, with significance noted mainly for the left ear (p<0.05).

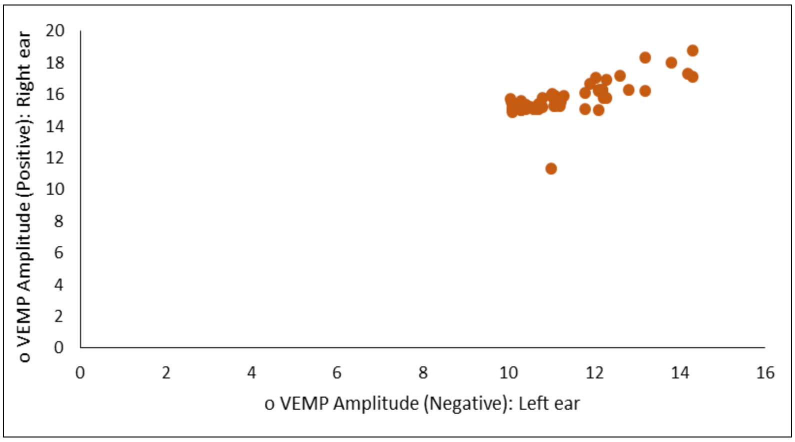
Table 10: Comparison of o VEMP amplitude according to its normal value

		Mean	S.D.	Test value	"t"	p value
o VEMP amplitude (Negative)	Right ear	11.26	1.17	10	8.34	< 0.001*
	Left ear	11.33	1.16	10	8.87	< 0.001*
o VEMP amplitude (Positive)	Right ear	15.74	1.04	15	5.50	< 0.001*
	Left ear	15.87	1.02	15	6.57	< 0.001*

(S.D = Standard Deviation, "t" = One sample "t" test; * Significant)



Graph 10(a): Represents the correlation between o VEMP Amplitude (Negative): Right ear and o VEMP Amplitude (Positive): Left ear



Graph 10(b): Represents the correlation between o VEMP Amplitude (Negative): Left ear and o VEMP Amplitude (Positive): Right ear

Table 10, Graph10 (a) and (b) shows the oVEMP Amplitude (Negative) group shows that both the right ear (mean: 11.26) and left ear (mean: 11.33) show significantly higher amplitudes compared to the normal value of 10. The differences are highly significant with $p<0.001$ for both ears. Similarly, o VEMP Amplitude (Positive) group shows that the right ear (mean: 15.74) and left ear (mean: 15.87) both show significantly higher amplitudes than the normal value of 15, with $p<0.001$ for both. There was a difference ($p<0.05$) in o VEMP amplitude (Both positive and negative) for right ear and left ear; according to its normal value.

Conclusion

The current study aimed to determine the Effect of Aging in Indian Population i.e study of Latency Shifting using oVEMP in the age range of 20-80 years. The vestibular evoked myogenic potential (oVEMP) test was administered to participants in a seated or reclined position, ensuring relaxation and stillness during the procedure. surface electrode were placed on IO (inferior oblique muscle). The non- inverting electrode was placed on contralateral belly-tendon area, as well as in inverting it was placed at below the non- inverting electrodes and ground on the forehead. The test was done in Meenakshi Ent Speciality Centre and Shabdha Speech and Hearing Center of Bengaluru, lasted 15 minutes, assessing vestibular function in individual aged 20-80 years. The primary objective was to evaluate latency shifts in n10 and p15 wave components with age.

Results revealed longer latencies in individuals aged >60years compared to younger adults, with larger amplitudes observed in younger group. Parametric statistical analysis (independent sample t-test) confirmed significant difference ($p<0.05$) in o VEMP amplitudes between age groups (20-60 years and 60-80 years) for both ears. The current study reported that increasing o VEMP amplitudes with age, suggesting age-related declines in vestibular function and asymmetry. Overall, o VEMP findings highlight significant age-related effects on vestibular function, with potential clinical implication for assessing vestibular health across age groups.

Future indication of the study

The study's generalizability can be enhanced by increasing the sample size or population, thereby allowing for broader applicability worldwide. The test's reliability can be improved by incorporating additional assessments such as VNG and VHIT, thereby creating a test battery to enhance its overall effectiveness. This study can serve as a reference for testing the broader population, including individuals with degenerative or pathological conditions.

Institutional Review Board statement

The study was conducted according to the guideline of the Declaration of Helsinki and was approved by the Local Ethics Committee of the University of Bangalore. Informed consent was obtained from all individual participants included in the study.

Ethics Approval and Consent to Participate

This study received ethical approval from the relevant institutional review board. Data collection permission was garanted by Meenakshi ENT Hospital, Bengaluru-560070 & Shabdha Speech and Hearing clinic, Bengaluru-560751. Informed consent was obtained from all participants before their involvement in study.

Author's contributions

All the authors have important contributions and participation in this research

Acknowledgement

I want to thank my parents, teacher, brother from the bottom of my heart for all of his help and encourgement during this research. His support and faith in me have been priceless. My gratitude to all the experts who are involved in the research proposal and the participants, without their passionate participation and input; it couldn't have been successfully conducted.

References

1. Zwierzyńska K, Lachowska M, Sokołowski J, Tataj E, Niemczyk K. Acoustic ocular vestibular evoked myogenic potentials (AC-oVEMP) in assessment of vertigo. Polski Przegl Otorynolaryngol. 2019;8(2):7-11.
2. Welgampola MS, Colebatch JG. Vestibulocollic reflexes: normal values and the effect of age. Clin Neurophysiol. 2001;112(11):1971-1979.
3. Todd NP, Rosengren SM, Colebatch JG. Ocular vestibular evoked myogenic potentials produced by impulsive transmastoid accelerations. Clin Neurophysiol. 2008;119(7):1638-1651.
4. Todd NPM, Rosengren SM, Aw ST, Colebatch JG. Ocular vestibular evoked myogenic potentials produced by air- and bone-conducted sound. Clin Neurophysiol. 2006;118(2):381-390.
5. Singh NK, Valappil N, Mithlaj JA. Response rates and test-retest reliability of ipsilateral and contralateral ocular vestibular evoked myogenic potentials in healthy adults. Audiol Res. 2015;13(3):126-133.
6. Singh NK, Firdose H, Barman A. Effect of advancing age on inter-frequency amplitude ratio of ocular vestibular evoked myogenic potentials. Int J Audiol. 2021;60(12):995-999.
7. Singh NK, Firdose H. Characterizing the age and stimulus frequency interaction for ocular vestibular-evoked myogenic potentials. Ear Hear. 2017;39(2):251-259.
8. Singh NK, Barman A. Characterizing the frequency tuning properties of air-conduction ocular vestibular evoked myogenic potentials in healthy individuals. Int J Audiol. 2013;52(12):849-854.
9. Rosengren SM, Govender S, Colebatch JG. Ocular and cervical vestibular evoked myogenic potentials produced by air- and bone-conducted stimuli: comparative properties and effects of age. Clin Neurophysiol. 2011;122(11):2282-2289.
10. Raveendran RK, Singh NK. Electrode montage-induced changes in air-conducted ocular vestibular-evoked myogenic potentials. Ear Hear. 2023;44( ): [pages not specified].
11. Nguyen KD, Welgampola MS, Carey JP. Test-retest reliability and age-related characteristics of the ocular and cervical vestibular evoked myogenic potential tests. Otol Neurotol. 2010;31(5):793-802.
12. Lee SK, Cha CI, Jung TS, Park DC, Yeo SG. Age-related differences in parameters of vestibular evoked myogenic potentials. Acta Otolaryngol. 2008;128(1):66-72.
13. Kumar K, Bhat JS, Sequeira NM, Bhojwani KM. Ageing effect on air-conducted ocular vestibular

evoked myogenic potential. Audiol Res. 2015;5(2):121-126.

14. Koukoulithras I, Drousia G, Kolokotsios S, Plexousakis M, Stamouli A, Roussos C, *et al*. A holistic approach to a dizzy patient: a practical update. Cureus. 2022;14( ): [article number].
15. Kuhn JJ, Lavender VH, Hunter LL, McGuire SE, Meinzen-Derr J, Keith RW, *et al*. Ocular vestibular evoked myogenic potentials: normative findings in children. J Am Acad Audiol. 2018;29(5):443-450.
16. Govender S, Rosengren SM, Colebatch JG. The effect of gaze direction on the ocular vestibular evoked myogenic potential produced by air-conducted sound. Clin Neurophysiol. 2009;120(7):1386-1391.
17. Govender S, Rosengren SM, Colebatch JG. Vestibular neuritis has selective effects on air- and bone-conducted cervical and ocular vestibular evoked myogenic potentials. Clin Neurophysiol. 2011;122(6):1246-1255.
18. Isaradisaikul S, Strong DA, Moushey JM, Gabbard SA, Ackley SR, Jenkins HA. Reliability of vestibular evoked myogenic potentials in healthy subjects. Otol Neurotol. 2008;29(4):542-544.
19. Jerin C, Berman A, Krause E, Ertl-Wagner B, Gürkov R. Ocular vestibular evoked myogenic potential frequency tuning in Ménière's disease. Hear Res. 2014;310:54-59.
20. El-Mahallawi TH, Gabr TA, Hamada SM, Monem SEA. Vestibular evoked myogenic potentials with different recording procedures. Egypt J Ear Nose Throat Allied Sci. 2012;13(3):113-120.
21. Felipe L, Santos MAR, Gonçalves DU. Vestibular myogenic evoked potential: evaluation of responses in normal individuals. Pro-Fono Rev Atual Cient. 2008;20(4):249-254.
22. Curthoys IS. The interpretation of clinical tests of peripheral vestibular function. Laryngoscope. 2012;122(6):1342-1352.
23. Curthoys IS, Vulovic V, Manzari L. Ocular vestibular-evoked myogenic potential to test utricular function: neural and oculomotor evidence. Acta Otorhinolaryngol Ital. 2012;32(1):41-45.
24. Deepak DT, Bhat JS, Kumar K. Ocular vestibular evoked myogenic potential using different test stimuli. ISRN Otolaryngol. 2013;2013:1-6.
25. Cheng P, Huang T, Young YH. Influence of clicks versus short tone bursts on vestibular evoked myogenic potentials. Ear Hear. 2003;24(3):195-197.
26. Asal S. Effect of age on ocular vestibular-evoked myogenic potentials using air-conducted sound. Egypt J Otolaryngol. 2014;30(2):166-170.
27. Basta D, Todt I, Ernst A. Normative data for P1/N1 latencies of vestibular evoked myogenic potentials induced by air- or bone-conducted tone bursts. Clin Neurophysiol. 2005;116(9):2216-2219.
28. Brix GS, Ovesen T, Devantier L. Vestibular evoked myogenic potential in healthy adolescents. Int J Pediatr Otorhinolaryngol. 2018;116:49-57.
29. Chang CM, Cheng PW, Wang SJ, Young YH. Effects of repetition rate of bone-conducted vibration on ocular and cervical vestibular-evoked myogenic potentials. Clin Neurophysiol. 2010;121(12):2121-2127.