

# Benign Paroxysmal Positional Vertigo and Concomitant Otolithic Dysfunction

## Abstract

**Objectives:** This prospective study is designed to clarify the association of Otolithic dysfunction (dysfunction of Utricle) in our outpatient service which is secondary referral otology and neurotology clinic. The parallel usage of OVEMP with ENG and VHIT is an asset to study site of lesion within vestibular system.

According to our findings in 152 patients complaining of vertigo compatible with BPPV, we could expect that recurrent canalolithiasis is originated from some dysfunction in Utricle. It may be due to dysfunction of Macula in maintaining the balance of calcium carbonate crystals (Statoconia) in the utricles. As a matter of fact, dysfunction of Utricle ignites the canalolithiasis resulting BPPV symptoms.

We studied all of our patients with true positional vertigo lasting for seconds and we confirmed BPPV with Hallpike's maneuver. We carried out Epley's maneuver for all patients and visited the patients regularly for assessment of treatment and possible recurrence.

We also checked all patients with oVEMP (ocular Vestibular Evoked Myogenic Potential), cVEMP (Cervical Vestibular Evoked Myogenic Potential) and ENG (Electro nystagmography). We found OVEMP abnormality without ENG abnormality that it specifically shows dysfunction of utricle. All patients are divided based on their age and recurrence and we evaluate the abnormality of OVEMP again.

Rate of OVEMP abnormality is much higher in patients with recurrent BPPV and it is very high in younger age group when we compare it with age more than 50 and the first attacks. We can logically conclude that canalolithiasis is not an accidental flow of calcium carbonate in the semicircular canals but it can happen when the balance of these particles impaired in utricle. This impairment can be associated with other structural abnormalities in the hydrodynamic characteristics of semi-circular canals making recurrent or reluctant BPPV.

**Keywords:** Benign paroxysmal positional vertigo; Utricle; Macula; Statoconia; oVEMP; cVEMP; ENG

**Abbreviations:** BPPV: Benign Paroxysmal Positional Vertigo; oVEMP: ocular Vestibular Evoked Myogenic Potential; cVEMP: cervical Vestibular Evoked Myogenic Potential; ENG: Electro Nystagmography; SVV: Subjective Visual Vertical

## Introduction

Benign paroxysmal positional vertigo (BPPV) is the most common form of positional vertigo, accounting for nearly one-half of patients with peripheral vestibular dysfunction. Approximately 18 percent of patients seen in dizziness clinics [1] and 25 percent of patients sent for vestibular testing have BPPV [2]. BPPV is also common in children [3] and accounts for about 20 percent of pediatric referrals [4].

In a population-based survey study, the lifetime prevalence of BPPV was 2.4 percent [5,6]. The one-year prevalence of BPPV increased with age and was seven times higher in those older than age 60 years, compared with those aged 18 to 39 years. BPPV was more common in women than men in all age groups. BPPV

could be related to different conditions. It may be spontaneous and idiopathic [7] or co-exist with some conditions such as Meniere's disease [2,8-10], head trauma [11], idiopathic sudden sensorineural hearing loss [12] or present after some surgery such as stapedectomy [13], even head-lying side during sleep correlate with side of BPPV [14]. Beside the wide spread of BPPV, the otolith function in these patients is unclear.

## Material and Method

A prospective case study was performed at a private otology & neurotology clinic. We did the study with patients' consent and they were aware of investigation for research purposes. We had 150 patients with BPPV in different ages, sexes. 90 patients were female and 60 were male. They were in two category of recurrent and the first attack. Mean age was 58.2 (11-85 y/o). The youngest was 15 and the oldest was 85 years old. We followed up the patients for three to twelve months after the first visit. We checked all patients with Hallpike's maneuver and diagnosed for unilateral BPPV in post semicircular Canal.

## Research Article

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We carried out the Epley's maneuver [15] for them and we checked oVEMP for all of the patients. We excluded the patient with underlying vestibular diseases such as Meniere disease, Migraine, Recurrent vestibulopathy, Vestibular Neuritis and central causes. All of our patients have normal ENGs that it shows superior vestibular nerve are normal and abnormal oVEMPs just showing abnormal utricular function.

We analysed data with SPSS 19 and all results approve our studies. We would like to look at the difference between BPVs

in different ages, then we divided the patient to three different age group 10-30, 30-50 and older than 50. We also like to find the difference of BPVs in recurrent and non- recurrent BPPVs, so we looked at the patients in two groups of recurrent and the 1<sup>st</sup> attack.

We researched about relation (searched for the relations) of abnormal oVEMP in the patients with BPPV and correlation between age, sex and recurrence with abnormal oVEMP (Table 1).

**Table 1:** Result of vestibular investigations in different age groups.

Age10-30	1 <sup>st</sup> attack with Abnormal oVEMP	Recurrent with Abnormal oVEMP
14	3	7 (50%)
Age 30-50	1 <sup>st</sup> attack with Abnormal oVEMP	Recurrent with Abnormal oVEMP
32	9	12 (37%)
Older than 50	1 <sup>st</sup> attack with Abnormal oVEMP	Recurrent with Abnormal oVEMP
106	23	28 (26%)

## Results

There was no significant relation between oVEMP and sexes (gender) in our study and almost both sexes had abnormal oVEMP (shouldn't this word be capital all the time?) if they had BPPV. We had 14 patients in the age group one (10-30). oVEMP was abnormal in 10 patients out of 14. Two patients had bilateral abnormal oVEMP and oVEMP was abnormal in 6 out of 14 patients in the same ear of BPPV (Table 2). We also had 32 patients in the second age group (30-50). oVEMP was abnormal in 22 out of 32.

Three patients had bilateral abnormal oVEMP and 18 had unilateral abnormal oVEMP in the same site of BPPV. One patient

had abnormal oVEMP on the opposite side (Table 3). In the third group (older than 50), we had 106 patients 51 to 83 of age. oVEMP was abnormal in 34 patients (Table 4).

We also look at the recurrent patients in the different age groups and its relationship with abnormal oVEMP. 70 patients out of 150 had a positive history of previous attack of the BPPV in the same or opposite side. oVEMP was abnormal in 50 patients. Recurrent patients were in different age groups. It significantly shows that in the youth and recurrent BPPV, we have more dysfunction in the utricle (Tables 5-8).

**Table 2:** The first age group (investigations and site of lesion).

Age(10-30)	14 (1.5%)
Bilateral Abnormal oVEMP	2
Unilateral Abnormal oVEMP same side	8 (57%)
Unilateral Abnormal oVEMP Opposite side	0

**Table 3:** The second age group (investigations and site of lesion).

Age (30-50)	32 (22%)
Bilateral Abnormal oVEMP	3
Unilateral & same side Abnormal oVEMP	18 (56%)
Unilateral & Opposite side Abnormal oVEMP	1

**Table 4:** The third age group (investigations and site of lesion).

Age older than 50	106 (70%)
Bilateral Abnormal oVEMP	15
Unilateral & same side Abnormal oVEMP	34 (32%)
Unilateral & Opposite side Abnormal oVEMP	2

**Table 5:** Statistical analysis.

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Correlations

**Table 6:** statistical analysis.

		Age	Recurrent	ovemp
Age	Pearson Correlation	1	-.123	-.187(*)
	Sig. (2-tailed)		.131	.021
	N	152	152	152
Recurrent	Pearson Correlation	-.123	1	-.327(**)
	Sig. (2-tailed)	.131		.000
	N	152	152	152
ovemp	Pearson Correlation	-.187(*)	-.327(**)	1
	Sig. (2-tailed)	.021	.000	
	N	152	152	152

\*Correlation is significant at the 0.05 level (2-tailed).

\*\*Correlation is significant at the 0.01 level (2-tailed).

[DataSet1] Correlations

**Table 7:** Statistical analysis.

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Syntax		CORRELATIONS /VARIABLES=Age recurrent ovemp /PRINT=TWOTAIL NOSIG /MISSING=PAIRWISE.
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**Table 8a:** Correlations (a), group=1.

		Age	Recurrent	ovemp
Age	Pearson Correlation	1	-.433	-.094
	Sig. (2-tailed)		.122	.748
	N	14	14	14
Recurrent	Pearson Correlation	-.433	1	-.452
	Sig. (2-tailed)	.122		.104
	N	14	14	14
ovemp	Pearson Correlation	-.094	-.452	1
	Sig. (2-tailed)	.748	.104	
	N	14	14	14

**Table 8b:** Correlations (a), group=2.

		Age	Recurrent	ovemp
Age	Pearson Correlation	1	.128	.239
	Sig. (2-tailed)		.486	.188
	N	32	32	32
Recurrent	Pearson Correlation	.128	1	-.509(**)
	Sig. (2-tailed)	.486		.003
	N	32	32	32
ovemp	Pearson Correlation	.239	-.509(**)	1
	Sig. (2-tailed)	.188	.003	
	N	32	32	32

\*\*Correlation is significant at the 0.01 level (2-tailed).

**Table 8c:** Correlations (a), group=3.

		Age	Recurrent	ovemp
Age	Pearson Correlation	1	-.208(*)	-.128
	Sig. (2-tailed)		.032	.191
	N	106	106	106
Recurrent	Pearson Correlation	-.208(*)	1	-.266(**)
	Sig. (2-tailed)	.032		.006
	N	106	106	106
ovemp	Pearson Correlation	-.128	-.266(**)	1
	Sig. (2-tailed)	.191	.006	
	N	106	106	106

\*Correlation is significant at the 0.05 level (2-tailed).

\*\*Correlation is significant at the 0.01 level (2-tailed).

## Conclusion

This study can help to explain and understand why calcium carbonate is separated from macula. When there is no balance in the calcium carbonate in the Statoconia and calcium carbonate suspension the utricle. BPPV can happen due to release of calcium carbonate in the Semi-Circular Canals. Macula can release it due to senile changes and even otoconial morphology change with

aging [16] but in the youth and patients with recurrent BPPV, we have more pathologies in the Macula because oVEMP shows abnormality in the function of Utricles. We may use oVEMP for prediction of recurrence in the young BPPV patients. The otolith damage also was shown in horizontal canal BPPV using static subjective visual vertical (SVV) test [17] or in saccule using cervical VEMP [18].

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