

Original Article

# Constant Dizziness Versus Episodic Vertigo in Ménière's Disease: Health-Related Quality of Life, Cognitive Dissonance, and Postural Problems

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**BACKGROUND:** The aim was to explore and characterize dizziness and vertigo (constant vs episodic) and associated problems in patients with Ménière's disease (MD) to allow characterization of the impact of the disease.

**METHODS:** The study used a retrospective survey design. A total of 539 people with MD participated in this study. The online questionnaire included 36 items which had mixture of structured and open-ended questions that were focusing on MD symptoms, impact of their symptoms, vestibular rehabilitation, as well as health-related quality of life (HRQoL).

**RESULTS:** Forty-six percent of the patients had episodic vertigo, 6% had constant dizziness, 15% had both episodic vertigo and constant dizziness, and 31% did not have vertigo or dizziness within the last 2 years. Patients with MD without any vertigo rated their HRQoL as 73.9%, those with episodic vertigo as 71.1%, those with constant dizziness as 56.9%, and those with constant dizziness and episodic vertigo as 57.9% indicating significant reduction in HRQoL in constant dizziness patients. Constant dizziness was associated with cognitive visual problems, fatigue, balance problems, vestibular drop attacks and syncope. The impact of balance problem was more severe among those with constant dizziness. The most common balance problem was tripping-off (34%), followed by swaying (25%) or rocking (8%) sensations. In the self-administered rehabilitative training, there were no differences between any of the vertigo or dizziness groups although disease profile of MD differed significantly.

**CONCLUSION:** We emphasize that constant dizziness in MD constitutes a long-term maladaptation to a vestibular and visual cognitive function causing cognitive dissonance. Different types of vertigo and their associated complaints require different treatment strategies to manage balance problems and to cope with the disease, but best practices is still under research.

**KEYWORDS:** Ménière's disease, Mal de-Debarquement syndrome, balance problems, swaying, rocking, tripping-off, quality of life

## INTRODUCTION

Although the inner ear changes in Ménière's disease (MD) can be demonstrated with MRI by accumulation of endolymph causing endolymphatic hydrops, the diagnosis is clinical and defined by at least 2 attacks of rotatory vertigo, tinnitus, and hearing loss with other diseases excluded.<sup>1</sup> The course of MD is chronic but often unpredictable, with pauses in the attacks and periods of exacerbation. The organ specific functional ailment does not describe the limitations experienced by the illness by individual patient.<sup>2</sup> Impairments such as fatigue, deficits in attention, visual-spatial construction, balance problems, among others are common in MD.<sup>3-6</sup> The reduction of health-related quality of life (HRQoL) in MD is largely explained by activity limitations, participation restrictions, and cognitive impairments,<sup>7,8</sup> but patients feel that their cognitive complaints are underrecognized, ill-managed, and largely attributed to psychological aspects.

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Different languages sometimes use only 1 word for dizziness and vertigo, and the case histories do not usually distinguish these 2 well.<sup>9</sup> Therefore, efforts have been put into defining vestibular symptoms by separating the terms vertigo and dizziness.<sup>10</sup> The character of vertigo in MD is episodic, but some patients also complain of constant dizziness. Dizziness comprises several vestibular-associated complaints as recently introduced disorders such as Mal deDearque-ment syndrome (MdDS) and persistent postural perceptual dizziness (PPPD), among others.<sup>11,12</sup> Mal deDearque-ment syndrome consists of rocking or swaying balance problems arising either spontaneously or associated with vestibular disease<sup>12</sup> and is suggested to be produced due to a mismatch in canal–otolith interaction or in the interaction between the visual and vestibular systems.<sup>13</sup> The PPPD manifests with one or more symptoms of dizziness, unsteadiness, or non-spinning vertigo that are present on most days for at least 3 months or more and are exacerbated by upright posture, active or passive move-ment, and exposure to moving or complex visual stimuli.<sup>14</sup> Emerging research suggests that PPPD may arise from functional changes in postural control mechanisms, multi-sensory information processing, or cortical integration of spatial orientation, and it is associated with psychopathological and cognitive consequences.<sup>14</sup> Even in MD, the Barany Society definition suggests that the MD is a broader concept than defined by episodic vestibular ailment but does not provide an explanation of dizziness by discrediting constant dizziness as a cru-cial factor in MD.<sup>15</sup>

The mechanisms and associated factors leading to constant dizzi-ness in MD are still a riddle, although balance problems, fatigue, and vestibular drop attacks carry a high odds ratio in explaining constant dizziness.<sup>16</sup> We propose to use the term constant dizziness to describe dizziness in MD outside the episodic vertigo attacks. In this paper, we explored and characterized dizziness and vertigo and associated problems such as HRQoL, visual impairments, pos-tural problems, vestibular function, associated subjective cognitive complaints, and current training approaches in patients with MD. Understanding the variability of the clinical picture in MD would be important from therapeutic aspects as it would allow the character-ization of the variability of the disease since the concept of constant dizziness causes misunderstanding among patients and doctors dealing with MD.

METHODS

Study Design and Participants

The study used a retrospective design. Ethical permission was obtained from the Vertigo and Ménière Federation (VMF) in Finland (Protocol no: 2022-06-08) to analyze registry data that VMF had collected from their members through an online questionnaire. Participants provided an electronic consent prior to completing the survey.

The VMF has 1739 members. The data collection started in 2005. The diagnosis of MD was based on criteria provided by the American Academy of Otolaryngology–Head and Neck Surgery (AAO-HNS).<sup>17</sup> The electronic survey was sent to only 1035 members who had provided their email, and from those, 539 individuals responded to the survey. This accounts for a 52.1% response rate. The mean age and duration of disease of the study participants were 61.9 years (range 17–89 years) and 15.6 years (range 0.5–40 years), respec-tively. The respondents included 423 (i.e., 79.5%) females, repre-senting the gender distribution of VMF. Female participants were 3.2 years younger than male participants. For additional questions on therapeutic procedures, we repeated the electronic survey for the 539 members, and 365 participants replied. The patients had been treated with contemporary therapy. The therapeutic regime indicates that for vertigo, only 4 therapies differed; intratympanic gentamicin-treated, antidepressant and psychotherapy users were more frequent in the vertigo-free group, and antiemetic users were more common in the vertigo group (see Table 1). To charac-terize the diagnosis of MD among VMF members, the diagnostic accuracy in a group of members (n = 706) was evaluated with an expert program and compared with the AAO-HNS criteria.<sup>18</sup> Results showed that 97% of respondents had definite MD and 2.7% had probable MD.

Data Collection

The data were collected using an electronic survey.<sup>19</sup> As descriptions of the quality of vertigo and dizziness described by the patients are based on personal experience, they may not match the doc-tor’s experience of complaint classifications, especially in classifying patients with dizziness.<sup>20</sup> Twelve VMF board members evaluated the

Table 1. Therapeutic Procedures in Treatment of Menière’s Disease

Therapeutic Approach	User Percentage (%)	No Vertigo	With Vertigo Attacks	Kruskal–Wallis Test (P)
Betahistin	61.9	91	135	P = .686
Diuretic	20.5	31	44	P = .709
Antiemetic	40.3	46	101	P = .009
IT-steroid	2.2	3	5	P = .909
IT-gentamicin	2.7	7	3	P = .045
Antidepressive	9.3	19	15	P = .040
ELS-surgery	1.4	1	4	P = .371
Psychotherapy	4.4	7	9	P = .719
Physiotherapy	23.8	20	67	P < .001

Drugs used, number of intra-tympanic therapy given, and the number of endolymphatic sac operated participants (n = 365). Also, psychotherapy and physiotherapy given are shown. IT indicates intratympanic application. ELS indicates endolymphatic sac surgery. The efficacy of therapy is tested against vertigo absence for more than 2 years. Differences between non-users are tested with the Kruskal–Wallis test.

questionnaire for content appropriateness, and revisions were made based on their suggestions. The 36-item questionnaire focused on several domains, including the MD complaints, such as balance problems and postural fitness, as well as socioeconomic issues (full-time or part-time sick leave, unemployment, education, impact of the complaints on daily activities). The structured questions focusing on complaints were rated on a 5-point scale ranging from "none" to "very severe." The vertigo attacks and vestibular drop attacks (VDA) were assessed by character, provoking items, frequency, severity, and the extent of the impact they caused. Characteristics of postural stability outside the attacks, problems with gait and impairment of mobility, and the impact of balance problems were queried. Questions on postural training habits were included. Two reminders were sent to encourage participation.

The VDA was defined as sudden imbalance without associated head movement. We classified VDA as "mild" when the patient experienced a sudden feeling of instability; as "moderate" when the patient searched for support to prevent falling; and as "severe" when the patient fell to the ground.<sup>21,22</sup> This definition of VDA covers a wider spectra of balance derangements than the original definition of "Tumarkin attacks."<sup>23</sup> Vestibular syncope has been described recently among 50% of patients who had severe VDA.<sup>24-26</sup>

In this study, we use the term "constant dizziness" as opposed to episodic vertigo in our questionnaire. The constant dizziness can be a fluctuating one, and mostly the patients experience better and worse days. We previously evaluated the complaints in MD and observed that the balance problem in logistic regression explained subjective constant dizziness but not episodic vertigo. Furthermore, when evaluating the impact of complaints in chronic MD, we have reported that the balance problems (44%) had a greater impact than episodic vertigo.<sup>27</sup>

Questions on the imbalance, for example: "Do you feel that you or the support surface would swing slowly like on the boat (with movement back and forth in about 5 sec)" or "Do you feel that you by yourself or with the support surface would experience a rocking sensation with rapid oscillation of the balance (with movement back and forth in about 1 second)?" were also included in the survey. Finally, we asked if they had balance problems that did not fit in these categories and classified these as non-defined balance problems. Frequency and intensity of balance problems as well as their association with visual problems were also examined. The impact of the disorder was rated on a 4-point scale from "no impact" to "severe impact." The visual analog scale (VAS) was adopted from the EuroQol EQ-5D-3L questionnaire regarding HRQoL questions.<sup>6</sup>

## Data Analysis

SPSS version 26 was used for data analysis. To compare different groups for continuous variables, Student's *t*-test and analysis of variance (ANOVA) were performed, and the Bonferroni post hoc test was used for pairwise comparisons. For categorical variables, non-parametric tests, such as chi-square, Mann-Whitney *U*-test, and Kruskal-Wallis *H*, were used. Responses to open-ended questions were also analyzed using qualitative content analysis.

## RESULTS

### Demographic Characteristics

From the 539 individuals with MD, 167 (31%) did not have any vertigo within the last 2 years. Two hundred and fifty-five (47.3%) had only episodic vertigo. Thirty-four (6.3%) had constant dizziness, and 83 (15.4%) had both episodic vertigo and constant dizziness (see Figure 1). We did not notice any significant gender differences between the different vertigo groups. However, significant group differences were observed in terms of duration of MD (ANOVA  $F = 7.813$ ,  $P < .001$ ). Those with episodic vertigo and constant dizziness (12.2 years) and those with episodic vertigo (14.3 years) had shorter durations when compared with those not having vertigo attacks within the 2 last years (19.7 years).

### Health-Related Quality of Life

The HRQoL measured using the VAS scale differed significantly ( $F = 14.113$ ,  $P < .001$ ) among the MD patients depending on the type of vertigo (see Figure 2). No-vertigo patients rated their HRQoL as 73.9. No difference in HRQoL was observed between episodic vertigo (71.1) patients ( $t = 1.239$ ,  $P = .216$ ) and no-vertigo patients. Patients with constant dizziness (HRQoL 56.9,  $t = 3.974$ ,  $P < .001$ ) and patients with constant dizziness and episodic vertigo (HRQoL 57.9,  $t = 5.277$ ,  $P < .001$ ) differed significantly from the no-vertigo patients.

Prevalence of migraine ( $P < .001$ ) and headache ( $P < .001$ ) was less common among subjects with no vertigo within 2 years (see Figure 3). In pairwise comparison, those with constant dizziness differed from non-vertigo participants in headache ( $P = .009$ ) but not in migraine ( $P = .098$ ), whereas subjects with episodic vertigo differed in both headache ( $P = .002$ ) and migraine ( $P = .005$ ). Patients with constant dizziness and episodic vertigo differed significantly from those with episodic vertigo in both headache ( $P = .010$ ) and migraine ( $P = .031$ ) but not from those with constant dizziness.

### Vestibular Function Associated with Attention and Visuospatial Cognitive Complaints

Fatigue interfering with daily life was reported by 31.7% of patients (see Table 2). It was less common in patients without vertigo within the last 2 years (17%), and this group differed from the episodic vertigo group ( $P < .001$ ) and constant dizziness group ( $P = .049$ ). Fatigue was especially prominent in the constant dizziness and episodic

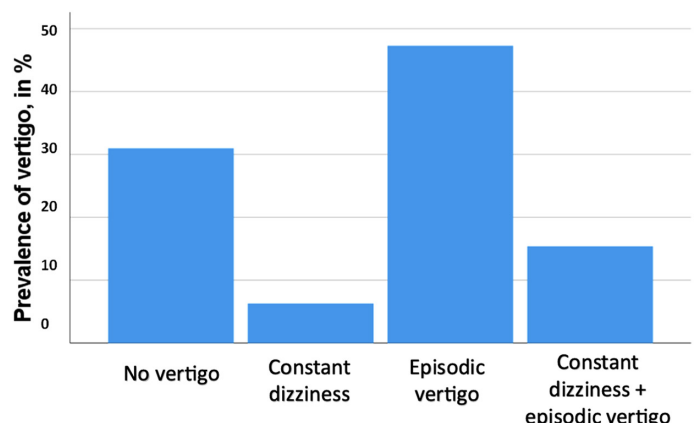
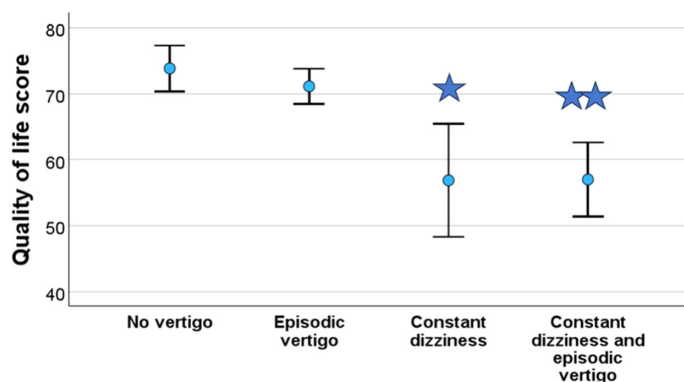


Figure 1. Classification of MD patients based on type of vertigo.



**Figure 2.** Health-related quality of life measured on the VAS scale (0-100) among MD patients with different types of vertigo. Mean and 95% confidence intervals are shown. Stars indicate statistical significance: \* $P < .05$ , \*\* $P < .01$  when compared to the no-vertigo group.

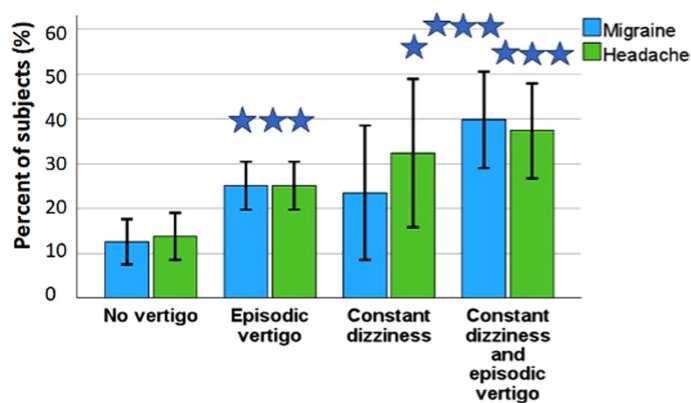
vertigo group, in whom 55% of the subjects reported fatigue that differed from all other groups ( $P < .001$ ).

Working with a computer screen (PC) was problematic for 10.8% of the participants but was less prevalent among subjects with no vertigo for 2 years and those with episodic vertigo. Fifteen percent of those with constant dizziness had problems with PC, and 17% of the constant dizziness and episodic group had problems with PC. This difference between the no-vertigo for 2 years group when compared to the constant dizziness and episodic vertigo group was statistically significant ( $P < .01$ ).

Vision during head movement was unstable in all vertigo groups (see Table 2) but was especially prominent in the constant dizziness group (41%), and this group differed significantly from all other vertigo groups ( $P = .017$ ).

Sensation of floating vision was especially common in the constant dizziness and episodic vertigo MD group (24%), and this group differed from other groups ( $P = .016$ ). Also, the constant dizziness group differed from the no vertigo within 2 years group (see Table 1).

In problems of focusing on objects, the constant dizziness group (41%) and the constant dizziness and episodic vertigo group (54%) had the most problems and the latter also differed from the episodic vertigo group ( $P < .001$ ) (see Table 2).



**Figure 3.** Migraine and headache in different vertigo groups. Mean and 95% confidence limits for means are shown. Stars indicate difference between no-vertigo group: \* $P < .05$ , \*\* $P < .01$ , \*\*\* $P < .001$ .

In visual distance evaluation, the constant dizziness and episodic vertigo group (34%) performed the worst ( $P = .016$ ) and differed from all other groups (see Table 2). Problems in busy traffic were noted in constant dizziness, episodic vertigo, and constant dizziness with episodic vertigo groups, with about half of the participants reporting issues, in contrast to 16% of the no vertigo within 2 years group (see Table 2).

### Balance Problems

The difference in the severity of balance problems between the vertigo groups was statistically significant ( $\chi^2 = 53.5$ ,  $P < .001$ ). The groups with moderate, severe, and very severe balance problems in different vertigo groups are shown in Figure 4. In pairwise comparisons, all vertigo and dizziness groups differed significantly from the no vertigo within 2 years group. Also, the constant dizziness group ( $P < .001$ ) and constant dizziness and episodic vertigo group ( $P < .001$ ) differed from participants with the episodic vertigo group and had more severe balance problems (see Figure 4).

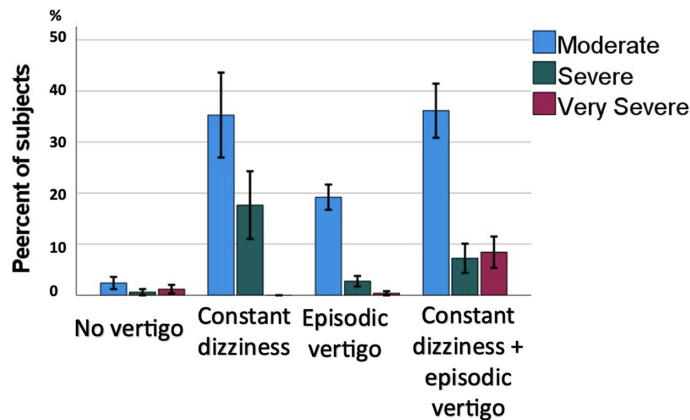
Most of the participants described their postural problems as swaying or a rocking sensation (30.8%) as illustrated in Table 3. Slow swaying and rocking sensations occurred less commonly, with a total of 122 (22.6%) and 44 (8.2%) participants, respectively. Stumbling was reported by 135 (25%) participants. Only 17 (3.2%) participants reported combined swaying and stumbling ( $n=14$ ) or rocking and stumbling ( $n=3$ ). Those with non-defined balance problems described them as occasional.

**Table 2.** Cognitive Complaints in Subjects with Menière's Disease Patient Groups Based on Vertigo Type

Cognitive Variable	No Vertigo for 2 Years (n = 167)	Constant Vertigo (n = 34)	Episodic Vertigo (n = 255)	Constant and Episodic (n = 83)	All (n = 539)	Significance
Fatigue	17.4	35.3*	32.9***	55.4***†	31.7***	$\chi^2 = 37.80$ , $P < .001$
PC-problems	6.0	14.7	11.4	16.9**	10.8*	$\chi^2 = 8.039$ , $P = .045$
Vision unstable during head movement	9.0	41.2***†	22.4***	28.9***	20.4***	$\chi^2 = 26.74$ , $P < .001$
Vision floating	2.4	11.8**	6.3	24.1***†	8.2***	$\chi^2 = 37-32$ , $P < .001$
Focusing problems	11.4	41.2***	28.6***	54.2***†	28.0***	$\chi^2 = 54.15$ , $P < .001$
Visual distance eval. Problems	9.0	11.8	14.5	33.7***†	15.6***	$\chi^2 = 26.92$ , $P < .001$
Problems in busy traffic	15.6	58.8***	41.2***	48.2***	15.4***	$\chi^2 = 46.52$ , $P < .001$

Percent of subjects in each group is shown. Stars indicate comparison with the no vertigo within 2 years group: \* $P < .05$ , \*\* $P < .001$ , \*\*\* $P < .001$ . †Indicates difference within vertigo groups.





**Figure 4.** Severity of balance problems classified as moderate, severe, and very severe among different vertigo groups.

The character of vertigo influenced the type of balance problem in MD patients, as shown in Table 2. Slow sway, as seen was present in about every fourth patient (23%), with higher prevalence among constant dizziness (24%), episodic vertigo (28%), and constant dizziness and episodic vertigo (39%); the difference was significant when compared with the no-vertigo group (11%). Fast sway as a rocking sensation was found in 8% of the patients and was very rare (2%) among subjects with no vertigo within 2 years, although there were no significant differences between active vertigo groups for rocking sensation. Within the different vertigo groups, there were some significant differences. Stumbling occurred in 25% of the participants and was most common in those with constant dizziness and those with constant dizziness and episodic vertigo. These 2 groups differed from the episodic vertigo group.

When analyzing the severity of VDA (i.e., stumbling, near falls, falls to the ground, injuries after VDA, and syncope in VDA) we found significant differences (see Table 4). When inspecting the differences in pairwise comparisons, the patients in the constant dizziness group differed from the no-vertigo group in terms of near falls ( $P < .001$ ), falls ( $P = .010$ ) and syncope ( $P = .009$ ) being more frequent. In the episodic vertigo group, mild VDA ( $P = .002$ ), moderate VDA ( $P < .001$ ), severe VDA ( $P = .012$ ), and syncope ( $P = .012$ ) were more common than in the no-vertigo group. In the episodic vertigo and constant dizziness group, mild VDA ( $P = .048$ ), moderate ( $P < .001$ ) severe VDA ( $P < .001$ ), injuries in VDA ( $P < .001$ ), and syncope ( $P < .001$ ) were common, and this group had frequent and severe consequences of VDA.

When inspecting the different training types between the different vertigo groups (see Figure 5), we did not observe that different

training modes such as non-training ( $P = .257$ ), walking ( $P = .846$ ), eye and balance training ( $P = .072$ ), guided training ( $P = .101$ ), and non-guided training groups ( $P = .214$ ) were different.

## DISCUSSION

### Cognitive Dysfunction and Dissonance

The cognitive dysfunction refers to a broad range of impairments or difficulties in cognitive functioning, which includes various mental processes such as perception, attention, memory, problem-solving, and executive functions.<sup>28</sup> Cognitive dysfunction can have a significant impact on daily functioning, including work, relationships, and overall quality of life. Humans with vestibular disorders exhibit a range of cognitive deficits, including mood, attention, and object recognition memory.<sup>29</sup> It may be temporary or chronic, and the severity can vary widely depending on the underlying cause. There is increasing evidence of the association between cognitive impairment in chronic vestibular disorders as in MD.<sup>6,30</sup> Damage to the vestibular system in animal studies leads to problems in spatial navigation and it is linked to otolith damage.<sup>31</sup> In humans, vestibular dysfunction adversely affects attentional processes, and increased attentional demands can worsen the postural sway associated with vestibular disorders, which correlates with their degree of impairment on spatial memory tasks.<sup>32</sup> In humans, vestibular damage has been associated with inactivation and secondary atrophy of the vestibular cortex—hippocampal pathways.<sup>33</sup> Cognitive dissonance is used to describe the shortage of a natural drive to maintain consistency between thoughts, sensations, and actions.<sup>34</sup> Several ways to reduce cognitive dissonance have been suggested, as changing behavior, psychotherapy, vestibular rehabilitation, and cognitive behavioral therapy (CBT). Thus, using different therapeutic modes, such as rehabilitative training, retiring from a job, or changing lifestyle are common techniques.<sup>35</sup> Cognitive behavioral therapy can help individuals learn to cope to manage their anxiety and reduce the emotional and functional aspects of dizziness. By addressing the underlying psychological factors contributing to dizziness, CBT can be an effective part of a comprehensive treatment plan.

The outcome of the present study showed that cognitive dissonance was associated with vestibular distrust, especially in patients having constant dizziness, and was less significant in patients who did not have vertigo for more than 2 years. Thus, the cessation of vertigo can significantly reduce the impact of cognitive dysfunction in daily life. The vestibular rehabilitation methods, either guided or non-guided training or visual training, were not effective in alleviating the cognitive dissonance. This is in line with previous reports.<sup>35</sup> In MD, we have established a peer support program that is based on CBT.<sup>36</sup> The program focuses on improvement of mood, attention,

**Table 3.** Occurrence of Different Types of Postural Problems in Ménière's Disease Patients Based on Vertigo Type

Variable	No Vertigo (n = 167)	Constant Vertigo (n = 34)	Episodic Vertigo (n = 255)	Constant and Episodic (n = 83)	All (n = 539)	Significance
Slow sway	11.4	23.5**	27.5***	30.1***	22.6***	$\chi^2 = 44.72, P < .001$
Rocking sensation	1.8	11.8*	10.6***	12.0**	8.2***	$\chi^2 = 38.26, P < .001$
Tripping off	24.6	38.2**†	18.8	38.6***†	25.0***	$\chi^2 = 36.16, P < .001$
Non-defined	22.8	11.8	18.8	6.0	17.6	$\chi^2 = 3.75, P = .290$

Numbers are given as a percent of participants in each group. The percentage of patients in each group is shown. Stars indicate comparison with the no vertigo within 2 years group:

\* $P < .05$ , \*\* $P < .01$ , \*\*\* $P < .001$ . †Indicates difference within vertigo groups when compared with the episodic vertigo group.

**Table 4.** Severity and Possible Injuries of Vestibular Drop Attacks (VDA) and Unconsciousness Associated with VDA in Different Vertigo Groups

Variable	No Vertigo (n = 167)	Constant Vertigo (n = 34)	Episodic Vertigo (n = 255)	Constant and Episodic (n = 83)	All (n = 539)	Significance
VDA tripping-off	18	21	31**	29	26	$\chi^2 = 10.27, P < .016$
VDA near fall	2	15***	11***	24***	10	$\chi^2 = 30.77, P < .001$
VDA fall	4	15**	10**	24***	11	$\chi^2 = 25.31, P < .001$
VDA injuries	2	3	5	19***	6	$\chi^2 = 26.84, P < .001$
VDA un-consciousness	1	9**	6**	11***	7	$\chi^2 = 11.39, P = .014$

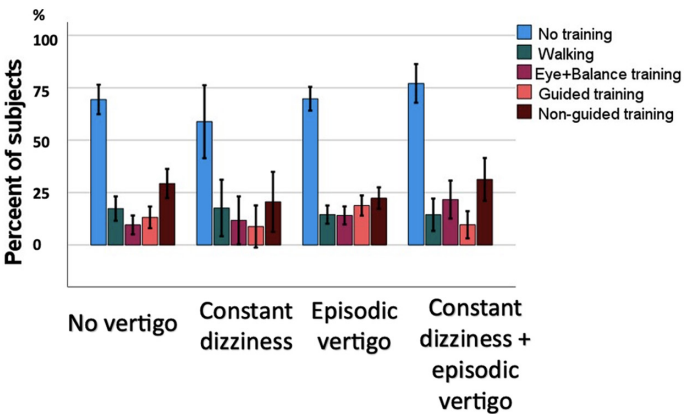
Number of participants are given in each group. \* $P < .05$ , \*\* $P < .001$ , \*\*\* $P < .001$ .

and cognition, and it improved the HRQoL significantly.<sup>36</sup> The next step would be to combine tailored rehabilitative training with the peer support program to treat cognitive dissonance. So far, there are limited number of studies producing consistent outcomes on the efficacy of CBT in cognitive dissociation.<sup>37</sup> The present results indicate that effective therapy for MD is essential in alleviating cognitive complaints.

**Vertigo, Dizziness, and Cognitive Complaints**

In the present study, 31% of MD did not have vertigo within the last 2 years, indicating either effective therapy<sup>16</sup> or variability in the course of MD. Still, 46% of the patients had episodic vertigo, 6% had constant dizziness, and 15% had both episodic dizziness and constant vertigo. So far, there are no detailed reports on constant dizziness, their association with cognitive complaints in MD, and neither explanation as to why vestibular ailments lead to constant dizziness without habituation.

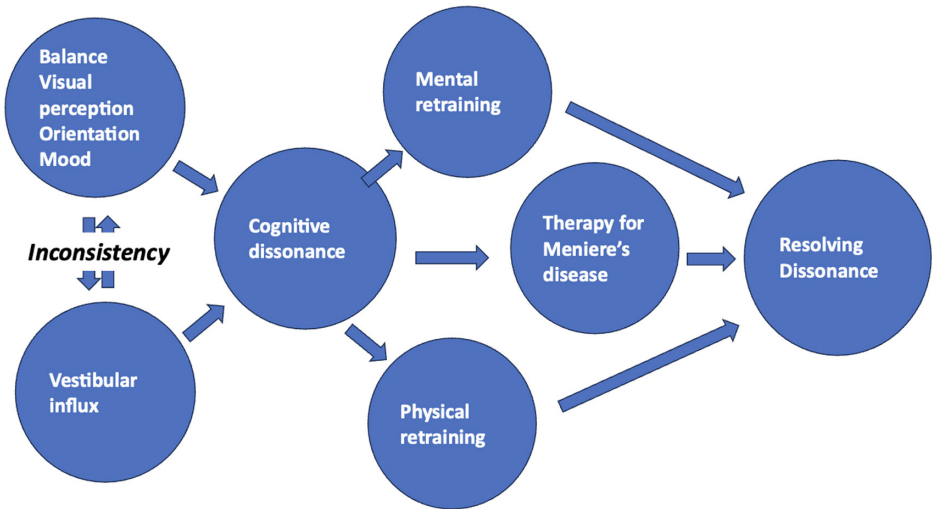
The importance of vestibular-cognitive functions of the cortical regions receiving vestibular projections has been shown both with single-neuron recording in primates<sup>38</sup> and with functional imaging of PET scans in humans.<sup>39</sup> Vestibular stimulation activates the vestibular cortex and inhibits the visual cortex, while a visual motion stimulus inhibits the vestibular cortex.<sup>39</sup> This suggested mutual inhibition is used to resolve visual-vestibular conflicts as the vestibular system is commonly involved in a visually oriented cognitive task (see Figure 6). We found visually influenced vestibular discomfort, especially in those with constant dizziness that we regarded as cognitive problems rather than impairment of spatial orientation, confirming



**Figure 5.** Different training habits in different vertigo groups. Mean and 95% confidence limits for means are shown.

the previous report.<sup>3</sup> Clinically, the vestibular-cognitive connection is many times discredited by dismissal of patient’s symptoms as purely psychological in origin.<sup>40</sup>

The socioeconomic status of the participants may influence HRQoL. In previous reports, MD had significant effects on employment, sick leave periods, and early retirement.<sup>41</sup> Complaints reported by those with MD with and without VDA differed, however. Thus, in self-rated work ability, the HRQoL was significantly worsened in patients with VDA. Those with VDA were afraid of tripping, injuries from falls, anxiety, problems in dyadic life. The socioeconomic status would be important as covariates in this study but was not considered in the



**Figure 6.** Suggested mechanism and therapeutic procedures in managing cognitive dissonance in Ménière’s disease.

final data analysis as the study concentrated only on the effects of MD on their cognition.

### Balance Problems, Fatigue, and Cognitive Dissociation

The balance problems in MD consist of different types. The swaying (25%) and rocking types (10%) of balance problems were found in one-third of the study participants with MD, and these were similar to spontaneous MdDS with visual disorientation, fatigue, constant dizziness, and headache, among others.<sup>12,16</sup> The disturbances in cognitive processing of somatosensory influx or even canal-otolith interaction potentially lead to reduced reliance on vestibular and visual systems.<sup>14</sup> The outcome of the present study in MD indicates that constant dizziness and episodic vertigo are complaints of the same disease and only describe different involvement of the neural network in the disease process. Moreover, in a recent study, we evaluated the impact of balance problems reported by individuals with MD who also had a long illness history.<sup>27</sup> One-third of the patients reported swaying types of postural problems similar to those with MdDS. These problems reduced HRQoL and were associated with visual problems. We hypothesize that the balance problems in MD are like that described in MdDS, where there is allegedly a mismatch within the sensory system.<sup>14</sup>

Generally, physical illnesses are associated with fatigue, although they are not explored clinically by physicians.<sup>42</sup> van't Leven et al<sup>43</sup> found that short-term fatigue affects 4.9% and chronic fatigue affects 30.5% of general population. In MD, one study found that 70% of the participants with MD reported fatigue.<sup>44</sup> In benign paroxysmal positional vertigo (BPPV), moderate fatigue was reported in 30% of the patients.<sup>45</sup> In the present study, headache and migraine were twice as common in the fatigue group than among those without fatigue (see Table 2). Fatigue was associated with balance and gait problems. The neural mechanism causing fatigue is largely unknown. We previously studied the multiunit recordings for the changes in the dorsal hippocampus of the rabbit for the effect of unilateral labyrinthectomy and confirmed that electrical brain activity was powerfully reduced in response to different stimulus modalities such as noise and vibration<sup>46</sup> indicating that the vestibular neural influx has a powerful effect on brain activity.

In a recent study, the most reported MD complaints were balance problems (44%).<sup>27</sup> However, only 22% recognized the obvious impact of their balance problems on their daily lives. The subjects with MD used quite similar balance training programs that were not related to their complaints. The patient's behavior is in contrast to information delivered by VMF on their home page, and AAO-HNS-based expert group indicated that subjects with vertigo attacks do not benefit from rehabilitation.<sup>47</sup> In our study on efficacy of training programs, we did not observe complaint-related differences in the programs, supporting the findings of the present study.<sup>27</sup> We conclude that different symptoms require different strategies to manage, and patient organizations may be the key source of information on this topic.

### Association of MD Cognitive Complaints to Migraine and PPPD

Concerning vestibular rehabilitation, a recent consensus document in the U.S. advocates against physiotherapy for periodic vertigo.<sup>47</sup> A recent literature review was inconclusive on the improvement of HRQoL following vestibular rehabilitation in patients with MD without considering the character of vertigo in MD.<sup>48</sup> Persistent postural

perceptual dizziness is a newly defined diagnostic disorder that unifies key features of chronic subjective dizziness, phobic postural vertigo, visual subjective vertigo, and related disorders.<sup>11</sup> The outcome of the present study indicates that constant dizziness and episodic vertigo are complaints of a similar kind of disorder, and cognitive complaints in MD and PPPD may describe different involvement of the neural network in the vestibular disease process. Also, in BPPV and acute vestibular disorders, some people might develop maladaptive compensatory mechanisms in their brain's balance system, leading to PPPD.<sup>49</sup> However, the evidence for this is still limited. The research on PPPD and its connection to these other conditions is ongoing. In patients with PPPD, self-administered vestibular rehabilitation based on the CBT principles resulted in a positive short-term effect, although this was not sustained at a 1-year follow-up.<sup>50</sup> Other study on patients with constant subjective vertigo found the results of CBT were more promising.<sup>51</sup> For MdDS, a special therapy with visual vestibular interaction training has been suggested, and with such therapy, about 70% of vestibular patients seem to respond positively.<sup>52</sup>

Our findings on migraine and headache support the role of migraine in constant vertigo. The International Headache Society and the Bárány Society re-named migraine-associated vertigo as vestibular migraine (VM).<sup>53</sup> Clinical features reported by the patient are used to classify VM.<sup>53</sup> We agree that probably those having complaints of headache are in fact migraineurs but do not meet the criteria for migraine or have not been neurologically evaluated. MD is frequently associated with headache and migraine, supporting our previous findings on VDA.<sup>24</sup> In addition, the results of the present study also indicate that migraine provokes the severity of MD. Based on a previous sophisticated study on migraineurs with MD, we could not confirm that the patients would have VM and suggest using the term MD with migraine<sup>25</sup> and also suggest that MD and VM may share similar pathophysiological mechanisms due to trigeminal innervation of vestibulo-cochlear arteries.<sup>28</sup> We cannot exclude that some of the MD with migraine could be in the future classified as VM. In the literature on VM, Tabet and Saliba<sup>54</sup> reviewed research dealing with MD and migraine and the association of MD with VM. They concluded that there is much overlap regarding symptomatology for these 2 conditions, thus creating diagnostic uncertainty of VM. At present, there is shortage of large studies dealing with MD and VM.

### Therapeutic Aspects of Cognitive Dissociation

In the present study, the patients used standard rehabilitation protocols, and the rehabilitation did not differ between constant dizziness, no-vertigo, or episodic vertigo groups. In a recent literature review, resistance exercise showed the highest probability of being the optimal exercise type for slowing cognitive decline in patients with cognitive dysfunction,<sup>55</sup> but greater cognitive benefits are gained from multidomain interventions.<sup>56</sup> In MD, there is limited evidence to alleviate cognitive maladjustment as, although improvement in the Dizziness Handicap Inventory was achieved, the values of cognitive failure questionnaires did not change.<sup>4</sup> The observations from the rehabilitation of MdDS suggest the possibility of tailoring individual therapy for subjects with MD suffering from constant dizziness. Pavlou et al<sup>57</sup> compared conventional personalized rehabilitation with visual dependence resolving rehabilitation and found that, although both relieved constant dizziness and anxiety, the visual dependence resolving program was more

effective. Recently, we have started to apply virtual reality training in our rehabilitation programs instead of conventional visual training.<sup>14</sup> Web-based peer support has also found to be useful in patients with MD to reduce psychological issues and improve HRQoL.<sup>36</sup>

Demirhana and Celebisoy<sup>58</sup> showed in a limited group of patients that episodic vestibular disorders in MD and VM without inter-ictal vestibular deficits do not seem to be associated with cognitive impairment. However, in that study, the patients were much younger (mean age of 46 years) and had a shorter duration of the disease (mean duration 2.2 years) than in our study. This may explain some differences between the no-vertigo and episodic vertigo groups in our study. There are also several other items that should be studied further, such as the use of specific questionnaire for cognitive problems.<sup>59</sup> However, our results indicate that items outside of The Cognitive Failures Questionnaire, especially the visual dominance of the cognitive complaints, indicate that one target in rehabilitation is to rescale the balance between visual dominance toward vestibular trust and reduce the cognitive dissonance.

One may argue that the medical therapy and exercise programs would influence the complaint profile of individuals with MD. Recently, we have evaluated the impact of medical therapy and exercise programs on MD-related complaints and HRQoL. Individuals who were prescribed physiotherapy and psychotherapy had poorer HRQoL, suggesting they may have a more severe impact of the disease, whereas the use of betahistine was associated with somewhat better HRQoL. The cessation of vertigo would improve cognitive complaints, and we therefore encourage the use of various medical treatments such as intratympanic steroids or gentamicin in otherwise therapy-resistant patients.

## CONCLUSION

The vestibular dysfunction in MD is complex, and there may be a tendency to lead practitioners toward the treatment of MD as a physical medical condition and as an organ-specific disease. However, the cognitive effect has not been fully appreciated. We believe that constant dizziness in MD constitutes a long-term maladaptation to vestibular and associative functions of the central nervous system and perhaps also psychological events that cause cognitive dissonance regarding orientation in space. Constant dizziness reduces HRQoL, leads to postural derangements, causes VDA, and provokes visual cognitive problems. The proper therapy has not been defined yet, but tailored vestibular and cognitive rehabilitation, as well as effective therapy for MD and mood disorders, may improve HRQoL and provide better adjustments than traditional vestibular rehabilitation therapy. The outcome of the present study indicates the need to modify the training instructions for MD with constant dizziness. However, the current exploratory study results must be viewed with caution, and prospective clinical trials are needed before generalizing these findings.

**Ethics Committee Approval:** Permission was obtained from the VMF to analyze registry data (protocol no: 2022-06-08) that the VMF had collected from their members through an online questionnaire.

**Informed Consent:** Electronic written informed consent was obtained from the patients/patient who agreed to take part in the study.

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