ORIGINAL ARTICLE

The Dizziness Handicap Inventory and Its Relationship with Vestibular Diseases

Mi Joo Kim, Kyu-Sung Kim, Yeon Hee Joo, Soo Young Park, Gyu Cheol Han

Department of Otolaryngology – Head and Neck Surgery, Graduate School of Medicine, Gachon University of Medicine and Science, Incheon, South Korea (MJK, YHJ, YP, GCH)
Department of Otorhinolaryngology-Head and Neck Surgery, Inha University College of Medicine, Incheon, Korea (KSK)

Objective: The degree of dizziness differs in peripheral vestibular diseases such as benign paroxysmal positional vertigo, Meniere's disease, and vestibular neuritis depending on the diseases. However, to date, there has been a limited amount of research conducted on the differences in subjective symptoms, handicap in daily life, and depressiveness of patients with each of these disorders, which cannot be measured by a vestibular function test. In this study, functional, emotional, and physical disorders were compared and analyzed prospectively using the Korean form Dizziness Handicap Inventory (K-DHI) with high reliability and validity.

Materials and Methods: The questionnaires were administered to the 150 patients diagnosed as Benign Paroxysmal Positional Vertigo(BPPV), definite Meniere's disease, and vestibular neuritis at the time of diagnosis and at the end of the treatment, such as vestibular rehabilitation or canalith repositioning procedure(CRP), and the patients with Meniere's disease underwent K-DHI during the follow-up period after the treatment. Comparative analyses have been carried out on each disease in terms of pre and post treatment and subcategories using the data from the questionnaire.

Results: The K-DHI scores were significantly higher in patients with definite Meniere's disease than patients with BPPV or vestibular neuritis and as for the subcategories of patients with BPPV, patients with lateral canal BPPV showed significantly higher scores. Female patients with definite Meniere's disease or vestibular neuritis that manifests a longer symptomatic period had higher scores than male patients.

Conclision: The degree of handicap due to dizziness was more severe in terms of functional, emotional, and physical limitations in patients with lateral canal BPPV and female patients. Therefore, more elaborated emotional stability and consultation are considered to be crucial.

Submitted : 29 December 2012 *Accepted : 16 January 2012*

Introduction

Dizziness is a subjective disorder that causes psychological, functional or social abnormalities rather than a simple pathological illness. [1] The rotatory chair test or caloric test is performed clinically to evaluate the vestibulo-ocular reflex (VOR), or dynamic posturography is carried out to evaluate the vestibulo-spinal reflex (VSR).

It is not uncommon that there is a difference between subjective symptoms and actual results obtained using the tests because these evaluation methods cannot consistently reflect the central compensation of vestibular deficits. That is to say, there is a difficulty in figuring out how much inconvenience patients with dizziness are experiencing and how much the subjective symptoms have been reduced. Therefore, the questionnaires are useful to quantify subjective symptoms and inconvenience that patients are suffering from, or to evaluate treatment outcomes objectively. [2-4]

Typical disorders that cause peripheral dizziness can differ not only in the severity of disease that patients feel, but also in influences on the pattern of daily life depending on a variety of factors, like attack

Corresponding address:
Gyu Cheol Han, MD, PhD Department of Otolaryngology-Head &
Neck Surgery, Gachon University Gil Hospital, Gachon University of
Medicine & Science, Graduate School of Medicine, 1198 Guwol-dong, Namdong-gu, Incheon 405-760, Korea
Phone: +82-32-460-3324, Fax +82-32-467-9044
E-mail: han@gilhospital.com

frequency, duration of disease, predictability of manifestation according to the presence or absence of triggering movements. There are rare comparative studies using severity of these subjective symptoms to provide grounds for a consultation on each disorder as well as to follow up on a disease.

This study was conducted to evaluate the clinical usefulness of K-DHI as an assessment tool through K-DHI psychometric analysis by comparatively analyzing functional, emotional and physical disabilities in terms of pre and post- treatment and variability or difference according to gender using K-DHI[5], which was standardized in Korean by Han et al. in 2004. Korean-adaptation of DHI had high internal consistency for the total scale (α=0.95) and high value of Goodness of Fitness Index (GFI=0.87).

Materials and Methods

This study was carried out prospectively according to the recommendations and the ethical principles of the assigned Institutional Review Board(IRB) at the Gachon University School of Medicine(GIRBA2248). The time period of this study was from January, 2009 to December, 2010. The total number of participants was 150. All of them came to the hospital through either outpatient department or ER, and were diagnosed with BPPV, Meniere's disease, and/or vestibular neuritis based on physical examination, vestibular function test, and hearing test.

There were 31 patients with the posterior canal BPPV, 6 patients with cupulolithiasis, 12 patients with canalolithiasis, 9 patients with the anterior canal BPPV, 60 patients with vestibular neuritis, and 32 patients with definite Meniere's disease.

The ratio of male to female participants was 1:1.38 with the age range from 26 to 79 (mean age of 52) years old. Patients were excluded if they had more than one peripheral dizziness disorders or multi-canal BPPV in which more than one canal are involved simultaneously.

The clinical syndrome of vestibular neuritis is characterized by the following -Persistent rotational vertigo with a pathological inclination of the visual vertical axis toward the side of the affected labyrinth -Spontaneous, horizontally rotating nystagmus -toward the unaffected side, producing apparent movement of the environment ("oscillopsia")- Gait deviation and falling tendency toward the affected side- Nausea and vomiting-Unilateral dysfunction of the horizontal semicircular canal, as revealed by the Halmagyi-Curthoys head impulse test for the function of the vestibulo- vestibulo-ocular reflex, as well as by caloric testing. [6-8]

For the diagnosis of definite Meniere's disease, we followed the criteria that were revised in 1995 by AAO-HSNF. [9] BPPV patients were not hospitalized. Rather, they were treated as outpatients with appropriate follow-up. Vestibular neuritis patients, on the other hand, were hospitalized to perform vestibular function test, and if the test results showed canal paresis with normal hearing ability, they were discharged after completing the educational course of vestibular rehabilitation. Meniere's disease patients were hospitalized only if they had endolymphatic sac decompression; the ones who were treated with drugs or intratympanic gentamicin (ITG) injection were not hospitalized. The definition of posterior semicircular canal BPPV was confined to cases showing vertical nystagmus during the Dix Hallpike test using video-nystagmography.

Lateral semicircular canal BPPV was confirmed with geotropic or ageotropic positional nystagmus observed during supine roll test. The lesion side was identified by the direction of nystagmus in the prone and supine position, the presence of Null point, and the extent of symptom and nystagmus in the both supine roll position. In horizontal canalolithiasis, nystagmus is geotropic or it beats towards the lower portion of the ear, with the fast phase towards the center of the earth, it is fatigable and lasts for less than 60 seconds. While in cupulolithiasis, it is apogeotropic, or towards the upper ear and persistent. In canalolithiasis, the direction of the greatest intensity of this nystagmus usually identifies the affected side. However, we did not distinguish the canalolithiasis and cupulolithiasis in this study.

Anterior canal type was distinguished with downbeating nystagmus including a rotatory

component in the Dix Hallpike test. Here, the direction of rotator component represents the side of lesion.

Patients answered the K-DHI form at the time of diagnosis and final visit after the treatment. Vestibular neuritis patients were asked to fill in the K-DHI form at their first visit followed by generic type of self vestibular rehabilitation. One month later, the final K-DHI form was answered. Definite Meniere's disease patients were asked to answer the first K-DHI form at the time of diagnosis, and the second K-DHI form was answered only if the patients had been taking diuretics (hydrochlorothiazide) for more than twelve months, or had endolymphatic sac surgery or ITG with close monitoring for more than twenty four months.

BPPV patients were asked to fill in the first K-DHI form if typical nystagmus was found on physical examination. Two days after canalith repositioning procedure(CRP), patients were asked to visit the outpatient clinic, and the second K-DHI form was answered if specific nystagmus was confirmed to be disappeared by the Dix-Hall pike and supine roll tests. Lateral canal BPPV(canalithiasis) patients were treated with barbecue method (log roll type, 360˚). Patients with lateral canal BPPV(cupulolithiasis) were educated to do head shaking for two weeks. Modified Epley maneuver and reverse modified Epley maneuver was performed on the patients with posterior canal BPPV and anterior canal BPPV respectively.

Informed consent was obtained from patients and their guardians. Patients were asked to fill in the questionnaires by themselves. Any necessary help in understanding the questionnaire were allowed to patients' guardian. Data analysis was conducted by using ANOVA of SPSS v17.0 (SPSS Inc., Chicago, IL, USA), and the cases with the p-value less than 0.05 were accepted to be statistically significant.

Results

In case of BPPV patients, according to the questionnaires answered prior to the treatment, resulted average scores of functional, emotional, and physical factors were 15.3, 10.0, and 12.1 respectively, and the total score was 37.5; however, these scores showed difference depending on which semicircular canal was involved.

The pre-treatment mean scores of functional, emotional, and physical factors, and the total score in the posterior semicircular canal type were 13.7, 8.0, 9.7, and 31.5 respectively. Those in the anterior semicircular type were 13.7, 10.3, 12, and 36.3 respectively. There was no statistical significance in the difference between posterior and anterior semicircular canal type. The scores in the lateral semicircular canal type were 18.9, 13.3, 16, and 48.2 which were significantly greater than the scores of anterior and posterior canal type of BPPV (Figure 1) ($p < 0.05$). All the categories of pre and post-treatment K-DHI scores in canalolithiasis and cupulolithiasis type among the lateral semicircular canal type showed no significant difference.

Compared to the pre-treatment K-DHI scores, the post-treatment scores were significantly reduced in all patients with BPPV after the canalith repositioning procedure (CRP) ($p < 0.05$).K-DHI scores in lateral canal BPPV patients showed statistical significance even after the treatment compared to the other canal type of BPPV (Figure 1).

The K-DHI scores of functional, emotional, and physical factors and total scores in patients with vestibular neuritis were 14.1, 10.3, 13, 37.1 respectively. When the patients were asked to repeat K-DHI after a month of discharge with completing the education of the generic type of self-rehabilitation method, there was a statistically significant decrease in the scores (5.8, 4.9, 4.4, 15.1)($p < 0.05$) (Figure 2).

The scores of functional, emotional, and physical factors and total score obtained from the first questionnaire administered to patients with definite Meniere's disease were similar to those in the lateral canal BPPV. The scores were 19.7, 12.6, 17, and 49.1 respectively before treatment. The scores, attained from the last questionnaire upon the completion of treatment, were 13.7, 5.4, 3.9, and 23 which were reduced significantly compared to the pre-treatment scores ($p < 0.05$) (Figure 2).

When comparing pre-treatment scores of functional, emotional, and physical factors between diseases, scores of all factors were significantly higher in patients with Meniere's disease than in patients with vestibular neuritis or BPPV, which implies that inconvenience or frustration that patients with definite Meniere's disease face in their daily life appears to be the greatest ($p < 0.05$).

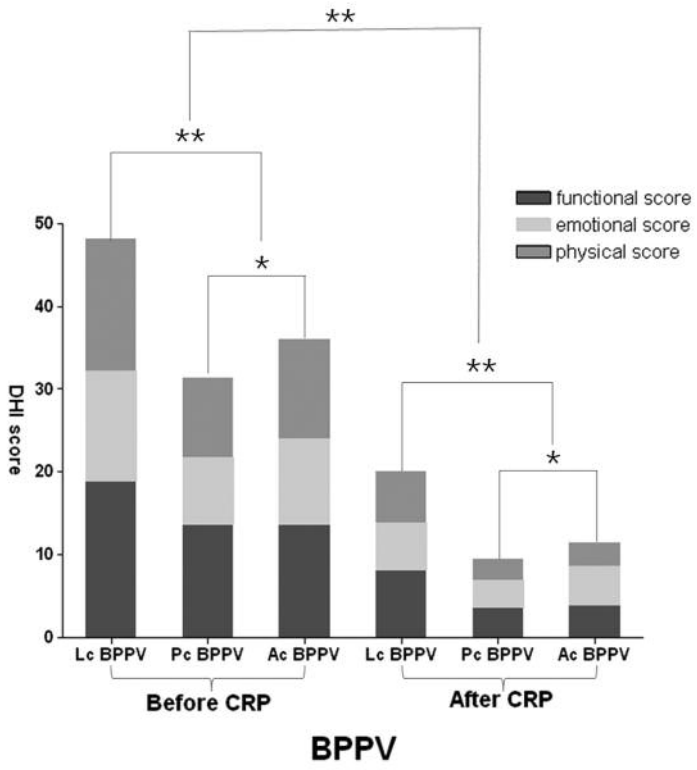

Figure 1. DHI scores of horizontal, posterior and anterior canal BPPV before and after treatment. The DHI score of lateral canal BPPV patients is higher than those of posterior and anterior canal BPPV patients before and after CRP. (** : statistically significant($p<0.05$), * : not statistically significant($p>0.05$), CRP : canalith repositioning)

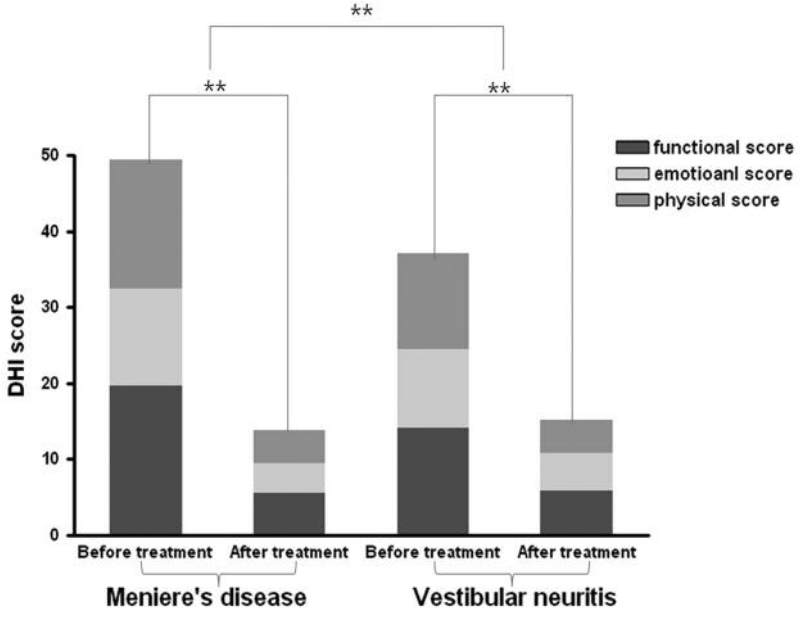

Figure 2. DHI scores of patients with vestibular neuritis & definite Meniere's disease before and after treatment. (** : statistically significant($p<0.05$))

In contrast, there was no difference in the scores between patients with vestibular neuritis and those with BPPV in all factors.

Generally among all groups, K-DHI scores in female were significantly higher than the ones in males. For each disease, pre-treatment scores of Meniere's disease and vestibular neuritis patients also showed the same gender difference although it disappeared after the treatment. No gender difference was found in both pre-treatment and post-treatment K-DHI scores of BPPV patients (Figure 3,4,5, 6).

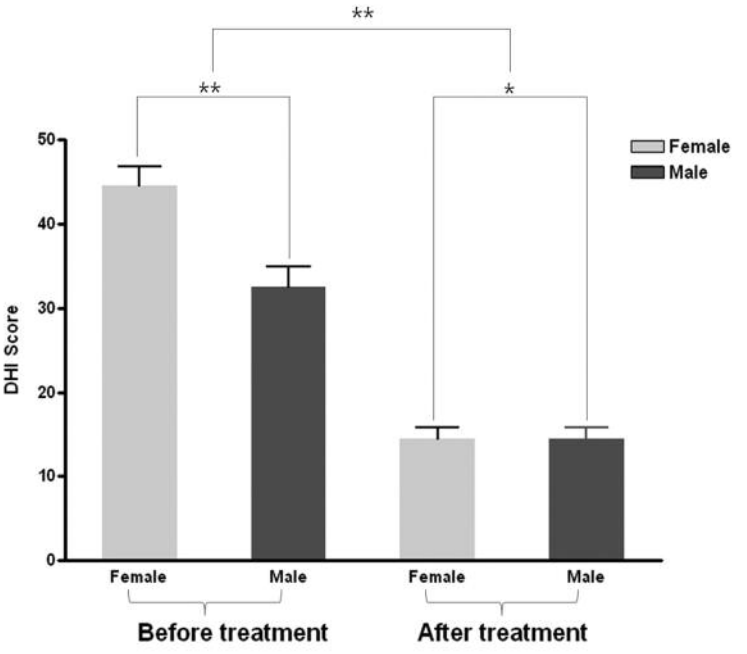

Figure 3. Comparison of the total DHI scores between female and male before and after treatment patients with peripheral vestibular diseases (BPPV, vestibular neuritis and definite Meniere's disease) (** : statistically significant($p<0.05$), * : not statistically significant($p>0.05$).

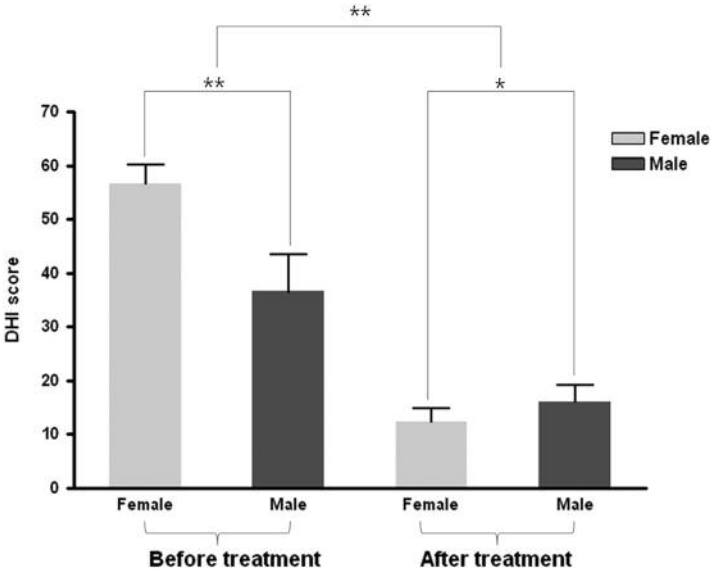

Figure 4. Comparison of the total DHI scores between female and male before and after treatment patients with definite Meniere's disease (** : statistically significant($p<0.05$), * : not statistically significant($p>0.05$).

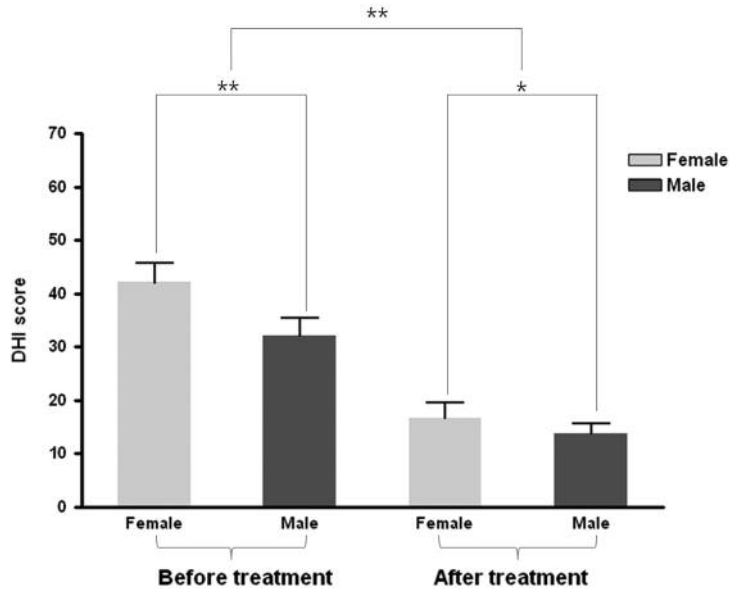

Figure 5. Comparison of the total DHI scores between female and male before and after treatment patients with vestibular neuritis (** : statistically significant($p<0.05$), * : not statistically significant($p>0.05$).

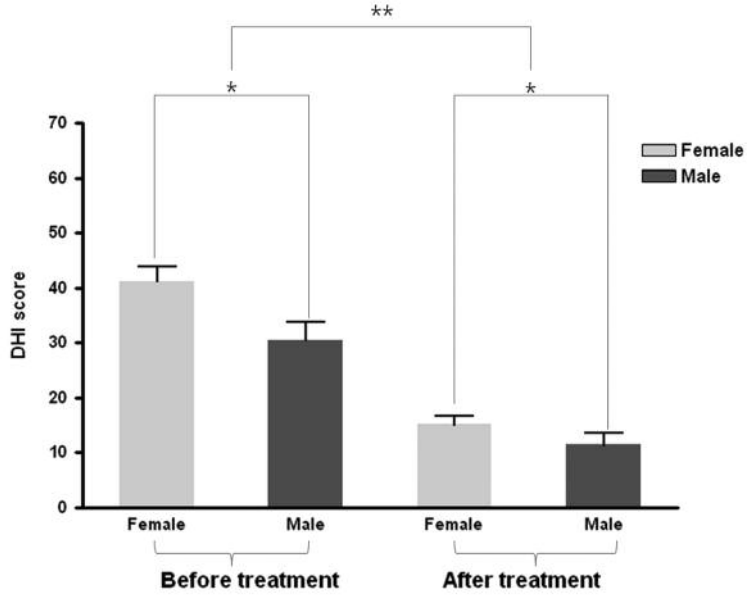

Figure 6. Comparison of the total DHI scores between female and male before and after treatment patients with BPPV (** : statistically significant($p<0.05$), * : not statistically significant($p>0.05$).

Discussion

The ability to maintain posture and orientation is one of the most indispensable conditions in daily life. This ability of maintaining posture is regulated by vestibule, somatic sensation, and vision. A problem with any one of these causes imbalance, which affects everyday life. This physical imbalance is known to disable patients' daily lives by taking a form of fear, depression, or anxiety. [10-12] This non-specific dizziness or differences

in sensitivity affect the pattern of individual life. Clinicians might feel that the degree of dizziness or influences on the life is different among each vestibular disease judging by long experience. However, adequate comparing data has not been attained.

DHI is the first self-assessment inventory to evaluate the degree of disability in everyday life associated with any cause of dizziness on patients suffering from dizziness, developed in 1990 by Jacobson and Newman.[14] Each item for the questionnaire is divided into functional, emotional, and physical area, being comprised of 25 questions, 3 levels, and 100 points, and the degree of disability is quantified based on total scores of each item. Among these, items of functional aspect are about occupation or movements related to leisure activity, items of emotional aspect are about anxiety and frustration associated with the occurrence of dizziness, and physical aspect is composed of items regarding basic physical movement often experienced in daily life. Validity of items was verified and reliability was shown to be high (Cronbach α 0.95). Especially, reliability of the questionnaire can be sustained when the test is translated into different languages. [5,13]

First, in the survey results from the BPPV patients, patients with the lateral canal BPPV had much higher scores than the patients with the other canal type BPPV in the functional, emotional, and physical factors, and the total score was higher as well. In the case of the lateral canal type BPPV, due to thirty degree of upward inclination of lateral canal front part, when patients keep their heads in upright position, the movement of otolith can occur; therefore, spontaneous nystagmus may be triggered.[15] This means that during the yaw movement, more dizziness occurs and also in lying, standing and sitting positions. Due to such characteristics, there are more frustrations and depression. When we compared between cupulolithiasis (n=5) and canalolithiasis type (n=13) of the lateral canal BPPV, there was no statistically significant difference. However, since the number of patients was small, further study will be needed. Both posterior and anterior canal BPPV show a similar result in all factors and total DHI scores indicating that there is little difference in the degree of inconveniences in daily lives. The scores of the vestibular neuritis patients were similar to the scores of the posterior and anterior BPPV patients but much lower than the lateral canal BPPV patients. This is because while the lateral canal BPPV shows repeated dizziness in all positions in daily lives, vestibular neuritis patients show improvements after acute phase.

Scores of the patients with definite Meniere's disease were significantly higher than those of the vestibular neuritis patients in the functional, emotional, and physical factors but showed little difference from those of the lateral canal BPPV patients. Since they were diagnosed with definite Meniere's disease, symptoms such as repetitive dizziness, decreased hearing ability, ear fullness, and tinnitus and more various or progressive symptoms are prevalent than other patients with dizziness. Therefore, we were able to predict their quality of lives were much worse than the patients with other vestibular disorder.

In this study, we did not include the patients with"possible" or "probable" Meniere's disease, therefore the results of the K-DHI based on the progression study of the Meniere's disease could be much different and we believe that more studies should be conducted.

In each class of the disorder, when we compared the K-DHI scores before and after the treatment, the post-treatment scores were decreased, and average score was below thirty implying that performing normal daily activity became possible. This reflects that the protocol of the treatment was quite efficient and had validity. However, scores of the Definite Meniere's disease patients and lateral canal BPPV patients were higher than the other vestibular disorder patients in the post-treatment results indicating that patients who scored high in the pre-treatment part still experienced inconveniences in performing daily activity and depression even after the symptoms have been improved by the treatment. If patient's emotional recovery is delayed, performing normal daily activities will be influenced. To these patients, providing emotional support and sense of assurance is more important even when the results from the vestibular function test are favorable.

When we compared each factor of other late stage vestibular disorders, the total score was high, and the results were all significant in the functional, emotional, and physical areas indicating that physical

inconvenience affects the emotion. Therefore, if the dizziness is severer, patients can develop more serious depression; therefore, treatment must be provided.

The scores were high in females in definite Meniere's disease and vestibular neuritis. The functional, emotional, and physical areas of scores were high in females in both disorders indicating that females experience more daily inconveniences and emotional issues. The score showed no difference in both sexes of BPPV patients. Therefore unlike Meniere's disease or vestibular neuritis, dizziness in BPPV is very temporary equalizing its intensity in males and females. However, females complained of more inconvenience from prolonged dizziness than males although this difference disappeared after treatment.

Patients with vertigo complain that the dizziness itself is the most difficult factor but there are many huddles in daily lives also. 16) These obstacles lead to limitations of physical and community activities and even sense of fear and low self-confidence. This finally brings a lower quality of life compared to healthy people. [17] There are studies that have reported that the quality of life of the vertigo patients is similar to the patients with chronic burdensome illness such as kidney disease, and rheumatic disorder. [8]

Although we have a good understanding of pathophysiology of many vestibular diseases, there are still many parts that we still do not. Especially the fact that result of clinical test such as vestibular function test does not reflect actual dizziness that patients experience, and the inconvenience and anxiety caused by it shows that pathophysiology only cannot explain every aspect of a certain vestibular disease. Therefore, K-DHI may narrow the gap between the test result and the patients' subjective symptom. Physicians are suggested to understand many obstacles that occur in daily lives of the patients with vertigo, and provide psychological counseling that help relieving depression and frustration, rather than only focusing on the vertigo, itself and its diagnosis and treatment.

Conclusion

In this study, disabilities in daily life, depressiveness, and physical restrictiveness due to dizziness of patients with peripheral vestibular diseases such as BPPV, vestibular neuritis, and Meniere's disease were quantified by the evaluations with K-DHI questionnaires before and after the treatment. The K-DHI scores were significantly higher in patients with definite Meniere's disease than patients with BPPV or vestibular neuritis and as for the subcategories of patients with BPPV, patients with lateral canal BPPV showed significantly higher scores. The degree of handicap due to dizziness was more severe in terms of functional, emotional, and physical limitations in patients with lateral canal BPPV and female patients. Therefore, more elaborated emotional stability and consultation are considered to be crucial to those patients.

References

1.Yardley L, Masson E, Verschuur C, Haacke N, Luxon L. Symptoms, anxiety and handicap in dizzy patients: development of the vertigo symptom scale. J Psychosom Res 1992; 36:731-41.

2. Powell LE, Myers AM. The activities-specific balance confidence (ABC) scale. J Gerontol A Biol Sci Med Sci. 1995; 50:28-34.

3. Cohen H, Ewell LR, Jenkins HA. Disability in Meniere's disease. Arch Otolaryngol Head Neck Surg. 1995; 121:29-37.

4. Cohen HS, Kimball KT, Adams AS. Application of the vestibular disorders activities of daily living scale. Laryngoscope 2000; 110:1204-9.

5. GC Han, EJ Lee, JH Lee, SN Park, HY Lee, EJ Jeon, et al. The Study of Standardization for a Korean Adaptation of Self-report Measures of Dizziness. Am J Epidemiol 2004; 3: 307-25.

6. Daniel M Kaplan, Youval Slovik. The head thrust test-technique, usefulness and limitations (How do I manage?) Int. Adv. Otol. 2005; 3:141-144

7. Halmagyi GM, Curthoys IS. A clinical sign of canal paresis. Arch Neurol 1988; 45: 737–39.

8) Theil D, Arbusow V, Derfuss T et al.: Prevalence of HSV-1 LAT in human trigeminal, geniculate, and vestibular ganglia and its implication for cranial nerve syndromes. Brain Pathol 2001; 11: 408–13.

9. Monsell EM. Committee on Hearing and Equilibrium guidelines for the diagnosis and evaluation of therapy in Meniere's disease. Otolaryngol Head Neck Surg 1995; 113:181-5.

10. Mendel B, Bergenius J, Languis A. Dizziness symptom severity and impact on daily living as perceived by patients suffering from peripheral vestibular disorder. Clin Otolaryngol Allied Sci 1999; 24:286-93.

11. Mendel B, Lutzen K, Bergenius J, Bjorvell H. Living with dizziness: an explorative study. J Adv Nurs 1997; 26:1134-41.

12. Fielder H, Denholm SW, Lyons RA, Fielder CP. Measurement of health status in patients with vertigo. Clin. Otolaryngol. 1996; 21:124-126.

13. Karapolat et al. Dizziness handicap inventory Reliability, validity and sensitivity to change of Turkish dizziness handicap inventory (DHI) in patients with unilateral peripheral vestibular disease. Int. Adv. Otol. 2009; 5:237-245

14. Jacobson GP, Newman CW. The development of the Dizziness Handicap Inventory. Arch Otolaryngol Head Neck Surg 1990; 116:424-7.

15. De Stefano A, Kulamarva G, Citraro L, Neri G, Croce A. Spontaneous nystagmus in benign paroxysmal positional vertigo. Am J Otolaryngol. 2011; 32:185-9.

16. Yardley L. Contribution of symptoms and beliefs to handicap in people with vertigo: a longitudinal study. Br. J. Clin. Psychol.1994; 33:101-113.

17. Enloe LJ & Shields RK. Evaluation of health-related quality of life in individuals with vestibular disease using disease-specific and general outcome measures. Phys. Ther. 1997; 77:890-903.