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RESEARCH ARTICLE

The effect of vestibular rehabilitation on dizziness and headache in patients with vestibular migraine

Moslem Shaabani[1], Amin Shahrokhi[2], Bahareh Soufinia[1*], Mohanna Javanbakht[1], Enayatollah Bakhshi[3]

[1]- Department of Audiology, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

[2]- Pediatric Neurorehabilitation Research Center, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

[3]- Department of Statistics, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

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Abstract

Background and Aim: Vestibular rehabilitation is suggested as one of the effective treatments for vestibular-originated dizziness and vertigo. As there is a proven biologic link between vestibular symptoms and headache, headache improvement with vestibular improvement after vestibular rehabilitation is expected. The aim of the present study was examining vestibular rehabilitation effects on dizziness and headache in 9−15 year old subjects with a vestibular migraine.

Methods: Eight subjects with vestibular migraine were referred to Rofeideh Rehabilitation Hospital after diagnosis by a pediatric neurologist. They were evaluated via dizziness handicap inventory (DHI), headache impact test-6 (HIT-6) and dizziness and headache frequency. Then they received a home-based vestibular rehabilitation and after one month they were reevaluated.

Results: After vestibular rehabilitation for one month, changes in the DHI and HIT-6 score were statistically significant ($p < 0.01$). In addition, reduction in the dizziness and headache frequency in a month was statistically significant.

Conclusion: As vestibular rehabilitation has noticeable effects on dizziness and headache, this treatment is introduced as an effective and non-invasive treatment in children and adolescents with a vestibular migraine.

Keywords: Vestibular migraine; children and adolescent; vestibular rehabilitation

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Introduction

Dizziness is the perception of changing sensation or disturbance in the patient's spatial orientation. Vertigo is one of the subsets of dizziness expressed as the perception of movement sensation and spinning of the person or his/her surrounding environment. Both conditions can be caused by the involvement of a peripheral or central vestibular system [1].

In general, vertigo attacks and dizziness are less common in children than in adults, and in comparison with other disorders, vestibular migraine (VM) is one of the most commonly known causes of dizziness in childhood [2,3]. VM refers to the expression of vestibular symptoms

* **Corresponding author:** Department of Audiology, University of Social Welfare and Rehabilitation Sciences, Daneshjoo Blvd., Evin, Tehran, 1985713834, Iran. Tel: 009821-22180066
E-mail: baharehsoufinia@gmail.com

along with migraine headaches. In 1964, Basser introduced this condition when conducting a study on children with benign paroxysmal vertigo of childhood (BPVC) and found association between migraine and dizziness in this age group [4]. The highest prevalence of migraine headaches has been reported in children aged 6-12 years [5], with a higher incidence in girls [3].

International classification of headache disorders, the 3rd edition (ICHD-3) is a basis for the diagnosis of VM [6].

Various studies have reported abnormalities in vestibular tests in children with VM, and have examined the likelihood of balance disorders in these children [3,7]. With regard to the expression of vestibular symptoms and proven interactions between balance abilities and other cognitive-behavioral abilities [8], follow up and management of these patients is important. In addition to modifying lifestyle and dietary, VM management includes medical treatment with medications used in the acute phase of the diseases or as prophylactic to reduce the frequency and severity of attacks. Drugs for treatment of acute vertigo attacks include vestibular blockers and triptans. The functional mechanism of these drugs is not clear; however, their side effects are sedation and cognitive skills reduction [9]. Prophylactic medications are tricyclic, topiramate, and cyproheptadine. They are effective in reducing the severity and frequency of attacks, but these drugs also have complications such as sedation, blurred vision, memory weakness, heart palpitations, etc. which should be taken into consideration [10].

Regarding the adverse effects of drugs and reported effect of vestibular rehabilitation (VR) on the quality of dizziness in adult patients [11], using this non-invasive treatment has been considered in children and adolescent with VM. In addition, vestibular symptoms have a headache-related biological basis [12,13] and interrelation of these two pathways in the brainstem, including parabrachial, raphe and locus coeruleus nuclei, and other structures with important role in modulating the sense of pain, have been proven [14]. Moreover, previous studies have highlighted the effect of VR on reducing the frequency and severity of headache in adults with VM [15]. Thus, it is expected that VR has a specific effect on the quality of dizziness and headache in the affected population. To study the vestibular rehabilitation on the quality of dizziness and vertigo in patients, we used the Persian version of dizziness handicap inventory (DHI). The improvement in scales of DHI indicates the reduction in the disability and shows patient's treatment [16,17]. In addition, to check the decreasing effect of hea-dache on the quality of the patients, we used the headache impact test (HIT-6) which was translated into Persian in 2013, and its reliability and validity have been found acceptable in examining the headache effect [18]. Also, the frequency of patient's dizziness and headache per month were asked.

This study aimed to investigate the effect of VR on dizziness and headache quality of eight children aged 9-15 years having VM and the results of DHI and HIT-6 questionnaires before and after vestibular rehabilitation were reported.

Methods

This study conducted on eight children (five girls and three boys) with VM (diagnosed by a pediatric neurologist, and according to ICDH-3 guidelines) with a mean (SD) age of 12.62 (SD = 2.66) years old referred to the Dizziness and Balance Clinic of Rofideh Rehabilitation Hospital. They were assessed by DHI, HIT-6 questionnaire and regarding their frequency of experiencing dizziness and headaches. All of the patients had already completed their course of treatment under the supervision of the pediatric neurological specialist; however, they had complained from occasional headaches and balance problems. The inclusion criteria were as follows: obtaining score ≥ 50 in HIT-6 questionnaire, complaining of headaches more than once a month, having ability to perform daily tasks, and lacking any visual impairment and diseases that interfere with the assessment and rehabilitation process. The exclusion criteria were unwillingness to continue the intervention, the parents' dis-sent with the child's participation in the study, and lack of cooperation in conducting tests or VR process at home.

In order to examine the effect of VR on dizziness (before and after the intervention), DHI and HIT-6 were used, in addition the frequency of experiencing dizziness and headaches were assessed.

The 25-item DHI is an instrument for assessing the functional, physical and emotional effects of dizziness and imbalance [17]. It has been used in various studies on this age group [19]. It is scored based on three-point Likert type scale answered as "always" (4 points), "sometimes" (2 points) and "no" (0 point). The total score ranges from 0 to 100.

In order to evaluate the frequency of dizziness, the number of dizziness in one month were recorded and rated in a range of 0-6: Never or less than once a week (0), once a week (1), 2−3 times a week (2), 4−6 times a week (3), once a day (4), more than once a day (5), always (6).

HIT-6 has six questions and evaluates the effect of headache under six subscales (pain intensity, social functioning, role functioning, vitality, cognitive functioning and psychological distress). The score for the selected responses is between 6 and 13, and the total score is between 36 and 78 [18]. The scores higher than 50 indicate the probability of having migraine headache. The Persian version of HIT-6 has been reported to have acceptable validity and reliability [18]. In addition, to evaluate the frequency of headaches, the number of headaches in one month were recorded and rated in a range of 0−6: Never or less than once a week (0), once a week (1), 2−3 times a week (2), 4−6 times a week (3), once a day (4), more than once a day (5), always (6). Next, the patients received VR based on the protocol used in the conducted study on adults with migraine [15], including the vestibulo-ocular reflex (VOR) and vestibulo-spinal reflex (VSR) exercises. The patients were asked to perform these exercises every day at home for one month. The exercises included seven VOR exercises (1: quick horizontal eye movement, 20 times; 2: quick vertical eye movement, 20 times; 3: eye tracking horizontal direction, 20 times; 4: eye tracking vertical direction, 20 times; 5: horizontal head movement with gazing at fixed target, 20 times; 6: vertical head movement with gazing at fixed target, 20 times; and 7: oblique head movement with gazing at fixed target, 20 times), eight static VSR exercises (1: standing up and sitting down with eyes open, three times; 2: standing up and sitting down with eyes closed, three times; 3: standing with eyes closed and feet open for 20 s; 4: standing with eyes closed and feet closed for 20 s; 5: standing with tandem gait with right foot in front for 20 s; 6: standing with tandem gait with left foot in front for 20 s; 7: one leg stand on the right foot for 20 s; and 8 one leg stand on the left foot for 20 s) and five dynamic VSR exercises (1: 180° turn to the left, three times; 2: 180° turn to the right, three times; 3:) walking for 10 m; 4: walking with horizontal head movement for 10 m; and 5: walking with vertical head movement for 10 m). After one month, tests were performed again and the results were reported.

All of the exercises were carried out at the presence of parents at the first session, and then at home along with delivering an illustrative booklet of the VR exercises. After two weeks, the children were recalled to the clinic and the accuracy of the exercises along with checking the report of exercise program delivered at home was reviewed. The full exercise report at the end of one-month VR was also examined and received.

Collected data were analyzed in SPSS 22. Since the distribution of the data was not normal, the Wilcoxon test was used to compare the results before and after VR.

Results

Results showed that the changes in DHI score and is subscales (physical, emotional, and functional) as well as the changes in HIT-6 score, and the frequency of dizziness and headaches were statistically significant ($p < 0.05$, Table 1).

Because in Persian version of DHI, score 12 is considered as the cut-off point between the normal range and the disease [16], the decline in four patients' scores following VR at the end of one month, put them in the normal range. Moreover, at the end of VR protocol, the HIT-6 scores of samples were less than 50, indicating a

Table 1. Mean (standard deviation) scores of tests before and after vestibular rehabilitation in children with vestibular migraine (n = 8)

	Mean (SD) score		
Test	**Before rehabilitation**	**After rehabilitation**	**p**
DHI			
Total	36 (12.37)	14.25 (6.27)	0.01
Emotional subscale	11.50 (4.77)	3.75 (2.49)	0.01
Functional subscale	13 (5.23)	4.25 (2.51)	0.01
Physical subscale	11.5 (4.98)	6.50 (3.16)	0.03
HIT-6	62.12 (7.10)	43.50 (4.75)	0.01
Frequency of dizziness	2.37 (3.25)	0.74 (0.37)	0.01
Frequency of headache	2.62 (0.91)	0.75 (0.70)	0.01

DHI; dizziness handicap inventory, HIT; headache impact test

decrease in the effect of headache on the patient's life.

Discussion

In this study, eight children with VM were evaluated (before and after VR) using DHI and HIT-6 tools and assessed with regard to the frequency of their dizziness and headache. The results showed a significant improvement in dizziness and headache of our patients with VM.

The current study results show a significant reduction in DHI score and its subscales. This indicates the effect of VR on balance problems, vestibular symptoms, and reduced disability in the patients that is consistent with the results of Sugaya et al. [15]. Also, Gottshall et al. [20] reported significant changes in DHI scores after implementing VR in adult patients with migraine-associated dizziness. In the study of Wrisley et al. [21] on patients with a history of migraine, VR reduced DHI scores; however, the changes in the emotional subscale was not significant. In our study, changes were significant in all subscales of DHI.

The decrease in the score of the HIT-6 questionnaire also reflects the effect of VR on headache. Sugaya et al. [15] in a study on adult patients with VM and those with tension-type headache, reported a significant improvement in HIT-6 scores after VR, and observed that the improvements were more prominently in VM compared to tension-type headache group. The decrease in the frequency of dizziness and headache was also reported in their study which is agreement with our results.

In various studies, VR has been reported as an efficient treatment for reducing vestibular disorders and headache in adults with VM [11,21]. Our study was also revealed the efficacy of VR in children and adolescent with VM, which is explained considering the link between vestibular and pain pathways in the brain [22,23]. The neurons of the vestibular and pain pathways have a neurochemical similarity with regard to serotonin and purinergic receptors. It has also been suggested that dizziness is associated with spasms of labyrinthine artery or ischemia in central vestibular pathways [12], and reversible neurochemical disorders in the vestibular pathways cause dizziness in patients. Therefore, VR, in addi-tion to improve the function of vestibule, affects the quality of headaches by compensating defects and determining new balance patterns for the patients. Considering the

improvement of psychological aspects such as anxiety, confusion and cognitive disorders under the influence of improved vestibular symptoms in patients, we can point out the important role of VR on cognitive processes and educational progress in children and adolescents.

Conclusion

Our test results indicate significant improvement after vestibular rehabilitation (VR). In addition, parents reported improvement of their children's educational and social status (which needs further studies). These findings support that VR, as a non-invasive treatment in children with vestibular migraine, can be effective and helpful in reducing balance disorders and frequent headaches and dizziness.

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Conflict of interest

The authors declare that they have no conflict of interest.

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