

Clinical Study on the Treatment of Residual Dizziness in Benign Paroxysmal Positional Vertigo with the Structural Balancing Acupuncture Method

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Abstract: Benign paroxysmal positional vertigo (BPPV) often has residual dizziness symptoms after manipulative repositioning, and acupuncture is experienced in treating this disease. In this study, 68 cases of BPPV were recruited and randomly divided into 2 groups: acupuncture combined with manipulative reset group and reset group, and acupuncture treatment was performed with empirically prescribed structural balancing acupuncture method. The Dizziness Handicap Inventory (DHI), Dizziness Visual Analog Scale (VAS), and the effective rate were assessed after two treatments. The results showed that the acupuncture combined with manipulative restoration group was able to reduce the DHI scale score significantly, and a trend change was seen in the visual analog scale (VAS) of dizziness and the effective rate between groups after treatment. The results showed that the combination of structural balancing and manipulative repositioning in the treatment of benign paroxysmal positional vertigo could improve the residual dizziness symptoms compared with manipulative repositioning alone, which can be clinically promoted and further validated in a large-sample RCT in the future.

Keywords: Acupuncture; Benign Paroxysmal Positional Vertigo; Residual Dizziness; Tubular Stone Repositioning Method

1. Introduction

Benign paroxysmal positional vertigo (BPPV) is one of the most common cause of acute dizziness [1]. Statistically, symptoms such as dizziness, vertigo, lightheadedness, or imbalance are present in about 3% of emergency cases, of which 15% had BPPV [2]. The cause of BPPV is calcium carbonate particles called otoliths,

which are displaced from the elliptical capsule into one of the semicircular canals, resulting in an illusory sense of motion [3]. Various theories have been proposed in the past to explain the pathophysiology of BPPV, but it was not until the work of Hall et al. and Epley that this tubulitis theory was described and confirmed [4]. The efficacy of using otolith repositioning maneuvers in the treatment of BPPV is definite, which has been recommended by the American Academy of Otolaryngology (AAOT) and the American Academy of Neurology [5,6]. Although repositioning is currently the most effective treatment, some patients with repositioned BPPV have residual nonspecific dizziness that is persistent or associated with positional changes, a feeling of lightheadedness, unsteady walking, a feeling of floating, and feelings of insecurity, anxiety, and depression for fear of reoccurring vertigo, referred to as residual dizziness [7]. Clinical treatment of residual dizziness is dominated by pharmacotherapy and physical therapy. There are 58% physicians typically prescribing vestibular depressant (e.g., antihistamines, benzodiazepines, phenothiazines, and anticholinergics) for the treatment of BPPV to alleviate acute symptoms. However, they do not directly improve the underlying pathophysiologic state. Moreover, many drugs have a wide range of side effects due to their complex mechanisms of action and do not specifically inhibit the peripheral or central vestibular system [8, 9]. Physical therapy, on the other hand, focuses on vestibular rehabilitation, which can be used to replace lost vestibular function and reduce or eliminate residual dizziness after repositioning through specific postural exercises and training in vision and proprioception. However, this therapy is based on high-frequency repetitive movement training, lacks systematic physical and chemical

therapeutic measures, and some patients are afraid of the dizziness and discomfort produced during the exercises, resulting in low training compliance and affecting the therapeutic effectiveness [7]. Acupuncture as a green therapy can effectively relieve the residual dizziness of BPPV patients after reset, and it has a high safety coefficient, is widely adapted to a wide range of people, and has a high degree of acceptance by patients [10,11]. Our team has some experience in applying structural balancing acupuncture to treat BPPV to improve the effective rate of repositioning and residual dizziness, so we conducted an exploratory randomized controlled trial to objectively evaluate its clinical efficacy and safety.

2. Methods

2.1 General Information

Using a loading design randomized controlled trial, 76 patients with BPPV were enrolled in the Department of Rehabilitation of the Ninth People's Hospital of Nanhai District, Foshan City, from January 2023 to May 2024, and were randomized into the combined group and the reset group according to a 1:1 ratio. The randomized sequence was generated by an independent researcher using SPSS 23.0, and the envelope method was used for random sequence concealment. According to the treatment protocol, it was not possible to blind the clinical investigators and patients in this study, so only the clinical evaluation and statistical sessions were blinded, and neither the clinical evaluators nor the statistical analysts were involved in the treatment of the subjects. The study was approved by the Medical Ethics Committee of the Ninth People's Hospital of Nanhai District, Foshan City (Ethics Approval No. 2220001004378-04).

2.2 Inclusion Criteria

(1) meeting the diagnostic criteria of the Guideline of diagnosis and treatment of benign paroxysmal positional vertigo (2017); (2) aged 18-70 years; and (3) signing an informed consent form.

2.3 Exclusion Criteria

(1) Pregnant women or those with extreme physical weakness; (2) mentally unstable persons; (3) accompanied by serious medical illness; (4) concurrently receiving other

treatments that may interfere with the efficacy of the therapy; and (5) ulcers and broken skin on the neck.

2.4 Criteria for Discontinuance and Dislodgement

If the condition worsens during treatment, such as unfavorable limb movement, unstable vital signs, or serious adverse events, the study should be promptly discontinued and symptomatic treatment should be provided; patients who stop treatment for any reason are treated according to the dislodgement; those who violate the study protocol are treated as shedding.

2.5 Interventions

2.5.1 Combined group

The combined group was treated with acupuncture combined with manipulative restoration method. The method of manual repositioning and subsequent vestibular rehabilitation training was detailed in the repositioning group. Acupuncture treatment was received after the manipulative restoration. The acupuncture program was the structural balancing acupuncture method that had been applying by our team for many years, and the prescription included two-part operation of acupuncture and moxibustion. First of all, the patient took the sitting position, took 0.25*40mm disposable acupuncture needles, select A-Shi point at the back of the cervical occiput and the meridian points Feng Shi, Wai Guan, Feng Chi, Zu Sanli, Zhong Wan, Xia Wan, Qi Hai, Guan Yuan, straight stabbing 1 inch, and then after obtaining the qi, perform the flat tonic and flat catharsis method, and then leave the needle for 20min and then get out of the needle. When the needle was left in the Baihui and Fengchi, moxibustion was performed. Acupuncture and moxibustion treatment once a day, a total of 2 treatments.

2.5.2 Repositioning group

The Dix-Hallpike test was used to determine the otoliths of the anterior and posterior semicircular canals. Operation: the doctor is located at the back of the patient, the patient sits on the side of the examination bed, the head is turned to the left side at 45 degrees and the head position is kept unchanged, the doctor supports the patient to lie down quickly and flat, the head is suspended in the air and is 30 degrees from the horizontal plane, at the same time, the patient is asked whether he feels vertigo or not, and the

nystagmus is observed for 1 minute, and the direction of the nystagmus appearing and changing is recorded; then the right side is examined according to the same method. In the test when the patient's side toward the ground, if the direction of nystagmus is observed to beat rapidly vertically upward, the lesion site is the posterior semicircular canal; if the direction of nystagmus is observed to beat rapidly vertically downward, the lesion occurs in the anterior semicircular canal, and finally check the patient's seated position for the emergence of nystagmus and reversal of its direction.

The rolling test is used to determine the otolith of the external semicircular canal. Operation: the doctor is located in the back of the patient, the patient takes the supine position, the head is bent forward by 20 degrees, the head is quickly turned to the left side and kept in the position for 1 minute without moving, ask whether there is any vertigo and observe the emergence of nystagmus; then the head position is turned back to the median line, and then quickly turned to the right side, ask the patient whether there is any vertigo, and observe and record the emergence of nystagmus. The nystagmus was characterized as horizontal groundward or dorsal nystagmus. During the examination, if the horizontally oriented nystagmus was strong and prolonged, this side was the affected side. Vestibular function training includes head-eye separation training, habituation training to regulate emotions: use breathing to regulate tension (inhale: stop: exhale = 4:2:8). Therapy was performed once per day for a total of two treatments.

2.5.3 Combined drugs

Subjects should not take medications that affect vestibular function or other symptomatic medications during the clinical study.

2.6 Observation Indicators

2.6.1 Dizziness Handicap Inventory (DHI)

The DHI scale, as a primary efficacy indicator, is a validated scale used to assess the severity of subjective symptoms in patients with vertigo. The scale consists of 25 items, which are rated in terms of the patient's affective E (9 items with 36 points), functional F (9 items with 36 points), and somatic P (7 items with 28 points). Each question has 3 answers, "yes, sometimes, no", and is scored as "4, 2, 0". The total score was 100 points, with a score of 0-30 as mild impairment, 31-60 as moderate impairment, and

61-100 as severe impairment, with higher scores indicating more severe symptoms.

2.6.2 Visual Analog Scale (VAS)

The VAS score is can be used to assess the patient's subjective feeling of vertigo, and some studies have applied it to assess vertigo and found the VAS to be reliable. Patients choose the appropriate scale according to the degree of vertigo or dizziness. 0cm: 0 points, no vertigo discomfort; 10cm: extreme vertigo discomfort; 1~3cm: 1~3 points, mild vertigo, not affecting work and life; 4~6cm: 4~6 points, moderate vertigo, affecting work, not affecting life; 7~10cm: 7~10 points, severe vertigo, intense vertigo, affecting work and life.

2.6.3 Effectiveness: clinical effectiveness was evaluated before and after treatment, using the reset evaluation criteria of the *Guidelines for the Diagnosis and Treatment of Benign Paroxysmal Positional Vertigo (2017)*: (1) Cure: positional vertigo disappeared, Dix-Hallpike (-) or roll test (-). (2) Effective: positional vertigo and/or positional nystagmus is reduced but does not disappear. (3) Ineffective: Positional vertigo and/or positional nystagmus not reduced, or even increased.

2.7 Statistical Methods

Data analysis was performed using SPSS 23.0 software. Measurement data conforming to normal distribution were expressed as mean \pm standard deviation ($\bar{x} \pm s$), and paired-sample t-test was used for intra-group comparisons when the variance was uniform, and two independent samples t-test for inter-group comparisons; t, test was used when the variance was not uniform; and measurement data not conforming to normal distribution were expressed as median and quartile, and statistically analyzed by non-parametric tests. Count data were expressed as frequencies or percentages, and the chi-square test was used for comparison between groups, and the nonparametric test was used for hierarchical data. Differences were considered statistically significant at $P < 0.05$.

3. Results

3.1 Comparison of Demographic and Clinical Data

A total of 76 subjects were recruited in this study, of which 4 subjects in the combined treatment group and 4 subjects in the manipulation group were excluded from the

analysis because they took betahistine and benzodiazepines on their own for symptomatic treatment in the course of clinical observation, which might have an impact on the results of the study. Finally, 34 cases of subjects in the combined group and 34 cases in the manipulation group were included in this study for statistical analysis. There was no statistical difference in the comparison of the general information of the subjects in the two groups, which were balanced at baseline and comparable (Table 1).

Table 1. Comparison of General Information between two Groups before Treatment

| Groups | Combined group (n=34) | Repositioning group (n=34) | P |
|-------------------------------|-----------------------|----------------------------|-------|
| Age(years, $\bar{x}\pm s$)* | 53.91 \pm 4.41 | 15.06 \pm 3.66 | 0.568 |
| Gender(male/female, n)# | 55.31 \pm 5.59 | 20.44 \pm 5.81 | 0.783 |
| Course(day, $\bar{x}\pm s$)* | 0.122 | <0.001 | 0.902 |

* Independent samples t-test; # Chi square test

3.2 DHI Scale

There was no statistically significant difference in the pre-treatment DHI scores between the two groups of subjects, and the scores in the combined group were lower than those in the reset group after treatment (Table 2).

Table 2. Comparison of DHI Scores before and after Treatment in the Two Groups ($\bar{x}\pm s$)

| Groups | Pre-treatment | Post-treatment |
|----------------------------|------------------|------------------|
| Combined group (n=34) | 53.91 \pm 4.41 | 15.06 \pm 3.66 |
| Repositioning group (n=34) | 55.31 \pm 5.59 | 20.44 \pm 5.81 |
| <i>P</i> | 0.122 | <0.001 |

Independent samples t-test.

3.3 Vertigo VAS Score

There was no statistically significant difference in vertigo VAS scores between the two groups before and after treatment, as shown in Table 3.

Table 3. Comparison of Vertigo VAS Scores before and after Treatment in the Two Groups ($\bar{x}\pm s$)

| Groups | Pre-treatment | Post-treatment |
|----------------------------|-----------------|-----------------|
| Combined group (n=34) | 7.94 \pm 0.87 | 2.47 \pm 1.82 |
| Repositioning group (n=34) | 8.06 \pm 1.00 | 2.50 \pm 1.98 |
| <i>P</i> | 0.331 | 0.628 |

Independent samples t-test.

3.4 Effectiveness Rate

There was no statistically significant difference in effectiveness rate between the two groups, but the combined group had a tendency to outperform the Repositioning group, as shown in Table 4.

Table 4 Comparison of Effective Rate between Two Groups

| Groups | Cure | Efficacy | null | Effective rate/% | P |
|----------------------------|------|----------|------|------------------|-------|
| Combined group (n=34) | 21 | 10 | 3 | 91.2% | 0.364 |
| Repositioning group (n=34) | 18 | 10 | 6 | 82.4% | |

Rank sum test.

4. Discussion

Otolithiasis is a kind of peripheral vertigo related to head position, the attack of vertigo is severe and short-lasting, usually not more than 1 minute, often accompanied by nystagmus, nausea, vomiting and unsteady walking, etc., and is prone to recurrent attacks. The clinical incidence of otolithiasis is (10.7~600)/100,000 [12], accounting for 20%~30% of patients with vestibular vertigo, mostly seen in middle-aged and elderly people over 50 years old, the incidence rate of women is higher than that of men, and the male-female ratio is 1:2, which is the first place in the category of vertigo diseases. Studies have shown that degenerative changes in the morphology of the inner ear, decreased levels of vitamin D, head trauma or surgery, viral infections, and circulatory disorders of the inner ear are the causes of otolithiasis, in addition to smoking, anxiety, and a family history of otolithiasis [13]. Many experts have proposed different theories on the pathogenesis of otolithiasis, and the most widely recognized theories include "canal stone disease" and "crural stone disease" [14]. Residual dizziness often exists in patients with otolithiasis after standardized tube stone repositioning, and the mechanism of occurrence is still not completely clear. Some scholars have speculated on the mechanism of residual dizziness [15]: perhaps due to incomplete repositioning, the residual otolith fragments will produce a mild sense of vertigo when the human body changes its position without nystagmus; perhaps the otolithic apparatus of one's own inner ear has dysfunction, and the combination of other vestibular lesions in the BPPV will also lead to vertigo; vertigo may also occur due to the fact that it takes a long time for the center to adapt

after the tube stone has been reset; or it may be affected by the psychological state; and there is also an explanation for the fact that there may be a variety of pathogenetic mechanisms for BPPV. Some studies have shown [16] that risk factors for residual vertigo after otolith repositioning are advanced age, female gender, secondary otolithiasis, anxiety, and winter onset.

This disease belongs to the category of "vertigo" in traditional Chinese medicine, with the location of the disease in the ear and the reaction in the head, and the occurrence of vertigo is related to the three organs of the liver, spleen and kidney. It is mentioned in *Su Wen*, which points out that vertigo is caused by the internal movement of liver wind, which can be caused by the aging of the body and the loss of kidney essence, and the insufficiency of liver yin due to the lack of water and wood, or emotional upset can easily lead to the liver's depression and the transformation of fire and injury to yin, both of which can cause liver wind to move internally, resulting in vertigo. The team's acupuncture prescription is based on the theory of meridians, tendons, qi and blood to regulate the structural balance to promote the recovery of qi and blood. Moxibustion has a warming effect in the theory of acupuncture, and in combination with acupuncture, it has the effect of both tonic and diarrhea, relaxing the tendons and regulating the qi and blood, which is in line with the disease mechanism of the mixture of deficiencies and realities. Among them, the posterior occipital ashi point, Baihui, Fengchi are localized selected points, which have the function of dispelling wind and waking up the brain and opening the orifices in traditional Chinese medicine treatment; the matching of Waiguan and Fengshi has the function of dispelling wind and relaxing the tendons; Zhongwan, Xiawan, Qihai, Guanyuan, and the Zusanli have the function of replenishing the qi and blood. Modern research shows that [17] dizziness is related to ischemia of vertebral-basilar artery and insufficient circulating blood flow in inner ear, vestibule and microcirculation of the vagus. After a lot of clinical tests, acupuncture [18] can regulate the blood flow rate and blood volume, and it can reduce the viscosity of the whole blood, plasma viscosity and blood lipids etc., so as to make the process of the blood entering into the posterior circulatory system smoothly, and then improve the ischemia and anoxia of the brain. Acupuncture head acupoints [19] can also

improve lymphatic circulation in the inner ear, reduce intra-lymphatic edema and so on. In addition, the role played by acupuncture meridian acupoints may be related to the regulation of the nerve center, through the stimulation of the nerve endings of the deep receptors at the acupoints, the transmission of impulse signals to the cerebral cortex, and then the brain to integrate the information, and the impulses through the nerves or bodily fluids to the five viscera, six internal organs, the limbs and the bones, which can be adjusted to the human body from the pathological state to the healthy state of the transition [20]. This study showed that although manipulative repositioning has been able to significantly improve the vertigo symptoms of otolithic patients, acupuncture combined with manipulative repositioning routine treatment was able to further increase the effective rate of vertigo improvement, and the DHI scale score and vertigo VAS scores still improved further after treatment, and no adverse effects of acupuncture therapy were detected in this clinical study, which suggests that structural balancing acupuncture treatment program is a green therapy, with precise efficacy, easy operation, and high safety and easy to operate with high safety, which is worthy of clinical promotion.

There are certain limitations in this study, such as less case data and observation indexes, shorter observation time of efficacy, and failure to show statistical differences in the effective rate and VAS scores in the case of a trend of differences between groups. In addition, this study failed to carry out long-term efficacy assessment such as timely follow-up, failed to observe the improvement of anxiety and depression in patients with residual dizziness, and lacked objective assessment and examination of patients' symptoms. In future studies, we can recalculate the sample size according to the results of this exploratory study, expand the sample size to carry out validation studies, and at the same time, select more objective indicators as observational indicators and design a more scientific and reasonable randomized controlled trial to observe the near-term and long-term efficacy of acupuncture treatment for residual dizziness after otolith repositioning.

5. Conclusions

The treatment of benign paroxysmal positional

vertigo with structural balancing combined with manipulative repositioning can significantly improve residual dizziness symptoms compared with manipulative repositioning alone, which is worthy of clinical application.

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