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RESEARCH ARTICLE

EFFICACY OF TWO DIFFERENT VESTIBULAR REHABILITATION APPROACHES FOR DIZZINESS IN VESTIBULAR DYSFUNCTION IN HEARING IMPAIRED CHILDREN

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ABSTRACT

Introduction: Dizziness is one of the most common symptoms of vestibular dysfunction. Gaze stability exercises and Brandt Daroff exercises are two most commonly used vestibular rehabilitation approaches used for vestibular dysfunction. Vestibular dysfunction is common in hearing impaired children mainly, the reason being that hearing and vestibular impulses are both sent via the vestibule-cochlear nerve. This study mainly compares the efficacy of gaze stability exercises and Brandt- Daroff exercises for dizziness in hearing impaired children with vestibular dysfunction.

Objectives:

1. To study the effect of Gaze Stability exercises on dizziness in hearing impaired children with vestibular dysfunction
2. To study the effect of Brandt- Daroff exercises on dizziness in hearing impaired children with vestibular dysfunction
3. To compare the effect of gaze stability exercises and Brandt – Daroff exercises on dizziness in hearing impaired children with vestibular dysfunction.

Methodology: Thirty one hearing impaired children between the ages of 10 to 17 with positive symptoms of vestibular dysfunction in any two tests out of the following four tests - Dix Hall Pike maneuver, Fukuda Step test, Roll's test and Sharpened Romberg's test were selected. Baseline evaluation for dizziness was done using Motion Sensitivity Quotient. The values obtained before and after intervention were recorded. Children were divided into two groups, Group A received Gaze Stability exercises and the Group B received Brandt- Daroff exercises. The duration for treatment for both groups was 10 days.

Results: There was significant improvement ($p<0.001$) in dizziness for Motion Sensitivity Quotient in both the groups. Both groups showed improvement in dizziness. However, the group which received Gaze Stability exercises showed more improvement than the Brandt- Daroff exercise group for dizziness.

Conclusion: The results of this study conclude that Gaze Stability exercises and Brandt- Daroff exercises are effective in treating vestibular dysfunction in hearing impaired children and helps improve dizziness. Gaze Stability exercises clinically showed a better outcome than Brandt- Daroff exercises for dizziness.

Key words: Gaze Stability Exercises, Brandt- Daroff Exercises, Vestibular Dysfunction, Dizziness.

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INTRODUCTION

Dizziness is one of the most common symptoms of vestibular dysfunction. There ar/e mainly two types of vestibular dysfunction, namely, central and peripheral vestibular dysfunction. Vertigo (an illusory sense of motion), nystagmus (involuntary movement of eyes- dancing eyes), visual instability on head movement, blurring or double vision, spinning sensation or dizziness, may or may not have hearing loss or tinnitus, may be fearful of movement or activities, asymmetrical posturing in sitting or standing, in coordination, disequilibrium (sense of balance loss) are the signs and symptoms of vestibular dysfunction (Khandare *et al.,* 2018 ; O' Sullivan and Schmit, 2000 and Susan and Richard, 2000). Gaze stability exercises and Brandt- Daroff exercises are two very common forms of vestibular rehabilitation therapy approaches used for vestibular dysfunction (Khandare *et al.,* 2018 ; O' Sullivan and Schmit, 2000). Gaze stability exercises are exercises that modify the ability of the vestibular system to modify the magnitude of vestibule-ocular reflex (VOR) in response to a given input (head movement). Adaptation of VOR occurs due to a combination of retinal slip with head movement. These exercises are performed with rapid active head rotations while watching a visual target and maintaining focus on the visual target during head movements. These are substitution and adaptation kind of exercises (Khandare *et al.,* 2018; O' Sullivan and Schmit, 2000).

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Brandt- Daroff exercises is a type of habituation exercise which are easy to perform. These exercises cause the debris to get dislodged from the cupula of the posterior semicircular canals and moves to a location that no longer affects the cupula during head movements. Thus, resolving the symptoms of dizziness (Khandare *et al.,* 2018; O' Sullivan and Schmit, 2007). Vestibular dysfunction is common in hearing impaired children. In a study in 2013, it was mentioned that 88% of hearing impaired children suffer from vestibular dysfunction.[4] This could mainly be due to hearing and vestibular impulses pass via the vestibule-cochlear nerve. Similarly, another study in 2018, found that vestibular dysfunction to be around 50% in hearing impaired children (Khandare *et al.,* 2018). Since, there has been a high prevalence of vestibular dysfunction in hearing impaired children; there is also a need to manage dizziness caused by vestibular dysfunction by using vestibular rehabilitation. Gaze Stability exercises and Brandt-Daroff exercises are two different types of exercises used to manage dizziness for vestibular rehabilitation. This study is an attempt to compare the effects of Gaze Stability exercises and Brandt-Daroff exercises for dizziness in hearing impaired children with vestibular dysfunction. The main aim of the study was to compare the effect of gaze stability exercises and Brandt-Daroff exercises for dizziness in hearing impaired children with vestibular dysfunction. The objectives of the study were, firstly, to study the effect of gaze stability exercises for dizziness in hearing impaired children with vestibular dysfunction. Secondly, to study the effect of Brandt-Daroff exercises for dizziness in hearing impaired children with vestibular dysfunction. Thirdly, to compare the effect of gaze stability exercises and Brandt- Daroff exercises for dizziness in hearing impaired children with vestibular dysfunction.

MATERIALS AND METHODOLOGY

Ethical committee consent was taken from Dr. D.Y. Patil College of Physiotherapy, Pune. Ethical committee review ID was DPU/ R & R(P)/ 336 (21)/17. All participants fulfilling the eligibility criteria were included into the study. An informed consent form was taken from the concerned participant's parent/caregiver. The participants were screened for vestibular dysfunction. Children with hearing impairment of both genders, those diagnosed with vestibular dysfunction by ear nose and throat specialist, age between 10 to 17 years and any two of the following four tests positive (Dix Hall Pike test, Supine Roll's test, Fukuda Stepping Test and Sharpened Romberg's test) were included in the study (Khandare *et al.,* 2018; Jerome *et al.,* 2013; Barker *et al.,* 2015; Susan and Richard, 2000; Julie *et al.,* 2009 and Johnson *et al.,* 2005). Children receiving some other form of treatment for vestibular dysfunction, suffering from other systemic disorders[9], low intelligent quotient (less than 70), musculoskeletal disorders like fractures, strains, sprains leading to imbalance, central or peripheral neurologic diseases leading to disturbed balance and those who were handicapped were excluded from the study. The study took place at Indian Red Cross Society, Pune from March to October, 2017.The children who fulfilled the eligibility criteria were divided into two groups using simple random sampling by using the coin toss method. Group A received the Gaze Stability exercises and Group B received the Brandt- Daroff exercises. On coin toss, the participants getting 'Heads' were put in Group A and those with 'Tails' were put in Group B. Motion sensitivity quotient was used as an outcome measure to assess dizziness in hearing impaired children with vestibular dysfunction.

The pre treatment assessment of dizziness was taken using the motion sensitivity quotient. Group A received gaze stability exercises which were designed to improve gaze stability. These exercises required the child to fixate on a visual target during either horizontal or vertical head movement. These exercises also require the child to perform eye-head movements between targets with the goal of seeing clearly during those tasks. Total time for eye movement exercises did not exceed 10 minutes per day. The distance for viewing near targets was kept at 40 cms whereas the distance for viewing distant targets was 200 cms (Khandare *et al.,* 2018). Group B received Brandt-Daroff exercises. It was performed by rapidly changing the position of head and reclining to the affected side and maintained for 20-30 second or until the symptoms resolve. The child was then made to sit again before attaining the similar position on the other side. Then, the child was made to sit again. This is the completion of one cycle of Brandt - Daroff exercise. Three to five cycles constitutes one set or session whose treatment time did noit exceed for more than 10 minutes (Khandare *et al.,* 2018).

Termination criteria: increased dizziness or discomfort, persistence of symptoms after a set (Khandare *et al.,* 2018).

Precautions: Adequate rest was provided between exercises, the child was supported during exercises including in eyes closed condition to prevent risk of fall if needed, entire set of exercises was performed under guidance of therapist. (Khandare *et al.,* 2018)

Safety (Khandare *et al.,* 2018): All necessary pre-requisite safety precautions were undertaken during the course of treatment. The motion sensitivity quotient was used for post treatment outcome assessment for dizziness. There were no dropouts from the study. The data was collected and results were analyzed. The subjects and the statistician were blinded (O' Sullivan and Schmitz, 2007).

RESULTS

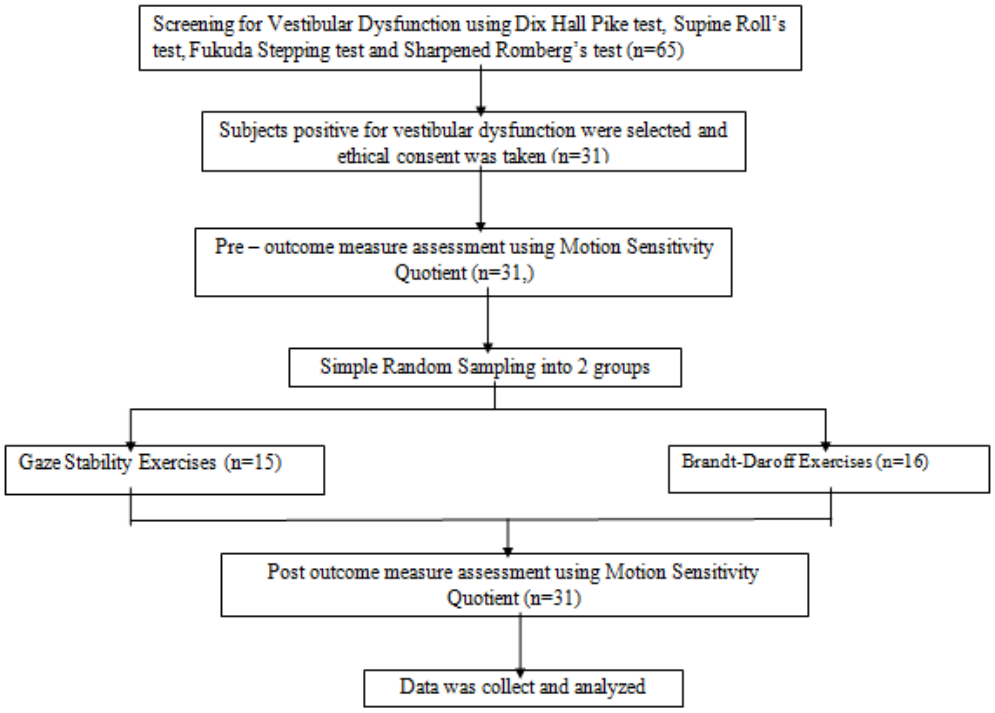
The data collected was analyzed using the Primer of Biostatistics, Version 7, 2011. The paired 't' and unpaired 't' tests were used within and in between groups for analysis. Graph 1 shows the pre and post scores of motion sensitivity quotient (MSQ) using the unpaired 't' test for both the groups

DISCUSSION

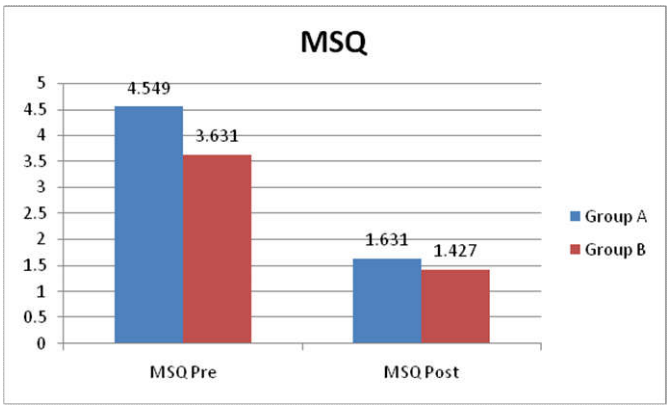
In our study 65 children were assessed for vestibular dysfunction. 3 children were excluded from the study as they did not meet the eligibility criteria. From the remaining 62 children, 31 children suffered from vestibular dysfunction. Vestibular dysfunction was prevalent in hearing impaired children in the population studied. From the study population 50% of the children suffered from vestibular dysfunction. This could mainly be due to involvement of the eighth cranial nerve as it is a common pathway for vestibular and hearing impulses. Similarly, Jerome A. et al in a study in 2013 found that 88% of the hearing impaired children screened suffered from vestibular dysfunction (Jerome *et al.,* 2013). Khandare S. et al in 2018 also found similar results about the prevalence of vestibular dysfunction in hearing impaired children (Khandare *et al.,* 2018). Our study showed greater improvement in dizziness symptoms in subjects receiving Gaze stability exercises.

Table 1. illustrates the treatment program for gaze stability exercises- Group A[1]

Days	Gaze Stability Exercises Program	Total time
1	Horizontal and vertical x1 viewing exercise with near target, 1 minute duration, sitting	2 min
2	Horizontal and vertical x1 viewing exercise with near target, 2 minute duration, sitting	4 min
3,4	Horizontal and vertical x1 viewing exercise with near and far targets, 2 minute duration, standing	8 min
5,6	Horizontal and vertical x1 viewing exercise with near and far targets, and targets located in front of a busy background, 2 minute duration, standing	10 min
7,8	Horizontal and vertical x1 viewing exercise with near and far targets, and targets located in front of a busy background. Horizontal and vertical x2 viewing exercise, plain background. All exercises 1 minute duration, standing	10 min
9,10	Horizontal and vertical x1 viewing exercise with near and far targets, and targets located in front of a busy background. Horizontal and vertical x2 viewing exercise, busy background. All exercises 1 minute duration, standing	10 min



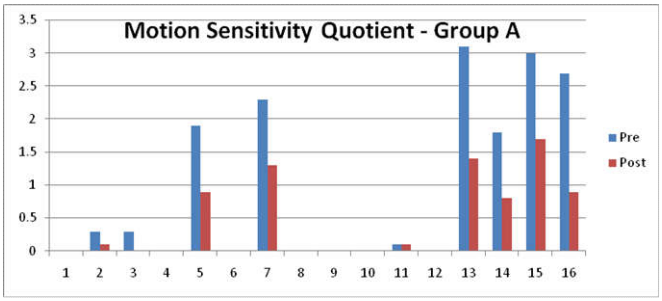
This improvement in Gaze Stability exercises could be due to adaptation which results in the resolution of the sensory mismatch between vestibular, visual and somatosensory inputs. Both the groups showed marked improvement in dizziness symptoms on Motion Sensitivity Quotient Testing.



Graph 1. Shows the pre and post scores of motion sensitivity quotient (MSQ) using the unpaired 't' test for both the groups

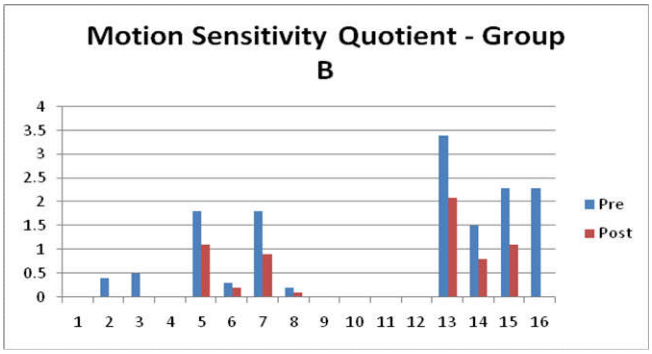
The improvement in Brandt- Daroff exercises could be due to central adaptation occurs reducing the nervous system responses to the signal from the posterior canal. It can also occur due to the dissolution of debris into the endolymph or dislodgement of debris into the posterior semicircular canals and moves to a location that no longer affects the cupula during head movements.

Gaze stability exercises showed more improvement mainly due to vestibular and visual system stimulation whilst Brandt-Daroff exercises provide vestibular stimulus. Hall C. et al in a study in 2010 also mentioned about improvement in dizziness symptoms after Gaze Stability exercises and a reduction in fall risk (Hall *et al.,* 2010.).

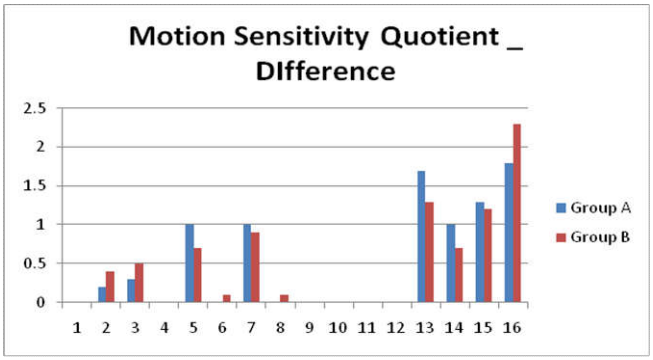


Graph 2. illustrates the pre and post values of Motion Sensitivity Quotient (MSQ) for each component for Group A

Shahanawaz S. and Rathod P. in 2015 also found similar improvement in dizziness symptoms with Brandt-Daroff exercises (Shahanawaz *et al.,* 2015). Tee L. and Chee N. in 2005 also mentioned that dizziness symptoms improved with vestibular rehabilitation therapy (Tee *et al.,* 2005). Herdman S. in 2000 in its book explained about the beneficial effects of Gaze Stability exercises and Brandt- Daroff exercises for dizziness symptoms in vestibular dysfunction patients.



Graph 3. illustrates the pre and post values of Motion Sensitivity Quotient (MSQ) for each component for Group B



Graph 4. Demonstrates the component wise value of the difference between the pre and post values of Motion Sensitivity Quotient for each group

They also mentioned about the effects of Vestibular Rehabilitation Therapy on dizziness in vestibular dysfunction (Susan and Richard, 2000). Similarly, Khandare S. et al in 2018 found gaze stability exercises to be more effective than Brandt-Daroff exercises in hearing impaired children for vestibular dysfunction (Khandare *et al.,* 2018).

Conclusion

Our study concludes that vestibular rehabilitation has a positive effect for improving dizziness in vestibular dysfunction. Gaze stability exercises and Brandt – Daroff exercises both had a positive prognostic outcome for dizziness in hearing impaired children with vestibular dysfunction. However, Gaze stability exercises had a clinically slightly better outcome than Brandt-Daroff exercises for dizziness in hearing impaired children with vestibular dysfunction.

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