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## Effectiveness of Brandt-daroff exercises on hearing impaired children: A Comparative Study

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### Abstract

**Title:** Effectiveness of Brandt-daroff exercises on hearing impaired children: A Comparative study. **Aim:** To find the effect of Brandt-daroff exercises on the vestibular dysfunction in hearing impaired children. **Objectives:** 1). To evaluate the effectiveness of the Brandt-daroff positional exercises on the dizziness in hearing impaired children. 2). To compare the effectiveness of the Brandt-daroff treatment administered by physiotherapist and teacher on hearing impaired children. **Methodology:** Out of 31 hearing impaired children that were included with the bilateral peripheral vestibular dysfunction, 21 students (GROUP I) were administered with the Brandt Daroff exercises for 2 weeks by the physiotherapist. For other 10 students (GROUP II) the Brandt-daroff exercises were taught to the teacher and then teacher administered the exercises for 2 weeks. The vestibular symptoms were assessed and documented by the Motion Sensitivity Testing, before and after the treatment of 2 weeks. **Results:** For Group I the result was significant (mean difference of 12.5). For Group II the result was significant (mean difference 5.98) however it was less than the Group I. **Conclusion:** The study concluded that the treatment protocol of Brandt-daroff exercises reduced the vestibular dysfunction in hearing impaired children. The exercises administered by physiotherapist were more effective. However the exercise can be administered by teacher or can be performed by child himself or can be given as the group therapy.

**Key Words:** Vestibular Dysfunction, Hearing Impaired, Brandt-daroff Exercises, Motion Sensitivity Testing.

### Introduction:

The ability to hear sound is crucial for typical development of language, so hearing loss is classified as communication disorder.<sup>1</sup> Hearing is an important sensory ability in psychomotor development of humans as it forms basis of communication for cognitive, affective and behavioral development and learning to take place.<sup>2</sup> Deafness is defined as a degree of impairment such that a person is unable to understand speech even in the presence of amplification. In profound deafness, even the loudest sounds produced by an audiometer may not be detected.<sup>3</sup> In India, according to the 47th Round of the National Sample Survey Organization (NSSO) taken in 1991,



3242000 subjects over the age of 5 have a hearing disability, which means 1 in 1000 live birth which is defined as a hearing impairment of 60 decibels and above.<sup>4</sup>

The incidence of peripheral vestibular disorders in children (e.g., Ménière's disease, perilymphatic fistula, benign paroxysmal positional vertigo [BPPV]) similar to that in adults has been reported.<sup>5,6</sup> Treatment of vestibular hypofunction in hearing impaired children can be done by 3 main types of exercises which are:

- Adaptation exercises- the recovery of the dynamic vestibulo-ocular responses are due to the adaptive capability of the vestibular system.
- Substitution mechanism-the substitution of other strategies to replace the lost function. Enhancement of gaze stability and dynamic visual acuity during predictable head movement.
- Habituation exercises-repeated exposure to a provocative stimulus will result in a reduction in the pathological response to that treatment. For eg. Eply's maneuver, Brandt-daroff exercise and Barbeque Roll-positioning maneuvers for dizziness based on the concept of repetition and habituation.<sup>7</sup>

The Brandt-daroff exercises are given as the habituation exercise in the vestibular dysfunction people. It is 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 rapid change to other side and maintaining that position for 20-30 seconds or until the symptoms resolve then made to sit again. This is completion of one cycle of Brandt-daroff exercise. 3-5 cycles constitutes one set or session.<sup>8</sup>

The Motion Sensitivity Test (MST) is a clinical protocol designed to measure motion-provoked dizziness during a series of 16 quick changes to head or body positions. Recording of the severity of the dizziness on a scale of 0 to 5 (0 = no symptoms; 5 = severe dizziness) and the duration of dizziness: 1 point for 5 s to 10 s of dizziness, 2 points for 11 s to 30 s of dizziness, and 3 points for >30 s of dizziness for each position and a cumulative score, the Motion Sensitivity Quotient (MSQ), is calculated by following formula.

Motion Sensitivity Quotient (MSQ) =  $[(\Sigma(\text{duration} + \text{intensity}) \times \text{No. of dizziness-provoking positions}) \div 2,048] \times 100$ .

The MST has been used as a guide for developing an exercise program for patients with motion-provoked dizziness and as a treatment outcome measure to monitor the effectiveness of vestibular rehabilitation therapy. The MST is reliable across raters (intraclass correlation coefficient [ICC] = 0.99) and test sessions (ICC = 0.98 and 0.96). Test validity is good. So, it indicates the MST can be used reliably in clinical practice to develop exercise programs for patients with motion-provoked dizziness and to provide evidence of intervention efficacy. MST can also be used in children with high reliability.<sup>9</sup>

There is paucity of research in the field of vestibular dysfunction treatment in the hearing impaired children, the Brandt-daroff is easy to explain, administer, less time consuming and can be given as a home treatment protocol. It was found that the effect of Brandt-daroff exercise on vestibular dysfunction in adults was effective in relieving dizziness.

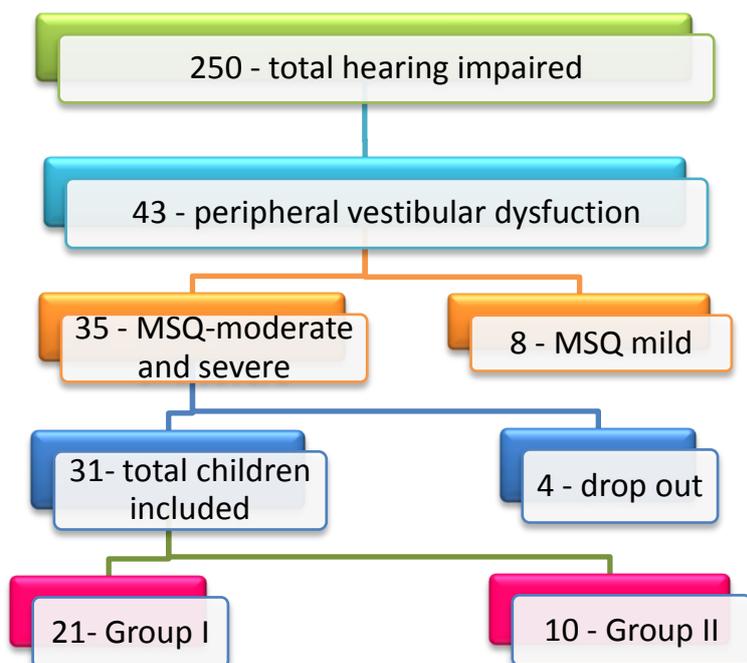
**Study design:** Comparative study



**Participants:**

Bilateral congenital hearing impaired children in the age group of 6-14 years who had peripheral vestibular dysfunction or was positive in two of the three following tests: Fukuda's stepping test, Hall pike dix test and roll's test And negative in: Romberg's and sharpened Romberg's test. Children who scores moderate to severe MSQ.

**Procedure:**



A written consent was taken from the parents and teachers regarding the hearing impaired child's participation. Total 250 children were screened out of which 43 students had peripheral vestibular dysfunction. The Motion Sensitivity Testing (MST) was administered on them; this score was documented as pre test score (MSQ-0) and out of them 35 students who scored MSQ more than 10 were included of which 4 were drop out. Hence, finally 31 students were included in the study.

Out of 31, 21 children formed group I who underwent exercise protocol of Brandt-daroff positional exercise performed by physiotherapist. These exercises were given for 2 weeks for 10 sessions. Each session consisted of 3 repetition of Brandt-daroff positional exercise both sides, with each position maintained for 15-20 seconds. At the end of 2 weeks children were re-evaluated on MSQ and was documented as the post test score (MSQ-1).

The other 10 students; were included in group II in which their school teacher administered Brand-daroff exercises on children, after learning the administration of Brandt-daroff exercises. Teacher administered exercise with same protocol. At the end of two weeks MSQ was evaluated and document as post test score (MSQ-1).

**Outcome measure:** Motion Sensitivity Testing (MST).



**Data analysis:**

TABLE-1 Independent sample tests for- MSQ-0 (Levene's test):

	t-test for Equality of Means			
	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference
Equal variances assumed	.075	3.9865371	2.1593003	-0.42 to 8.40
Equal variances not assumed	.016	3.9865371	1.5392795	0.810 to 7.16

Table-2 Effect of administration of Brandt-daroff administered by teacher and physiotherapy. Ancova testing:

Dependent Variable : MSQ 1						
Source	Type III Sum of Squares	Degrees of freedom	Mean Square	F	Sig. (p)	Partial Eta Squared
Corrected Model	158.821 <sup>a</sup>	2	79.410	61.713	0.000	0.815
Intercept	0.148	1	0.148	0.115	0.737	0.004
MSQ0	117.104	1	117.104	91.007	0.000	0.765
Group	92.529	1	92.5529	71.909	0.000	0.720
Error	36.029	28	1.287			
Total	969.736	31				
Corrected Total	194.850	30				

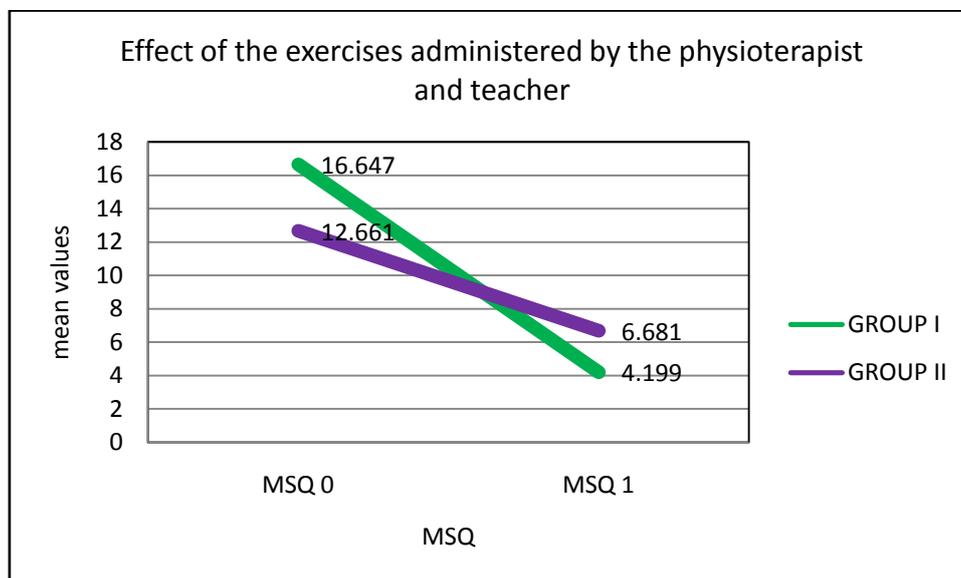
a. R Squared = .815 (Adjusted R Squared = .802)

Table-3 Mean difference of the MSQ of the exercise by Physiotherapist (Group I) and Teacher (Group II):

Groups	Group I (N=21)		Group II (N=10)	
	Mean	Std. Deviation	Mean	Std. Deviation
MSQ 0	16.647	6.6872242	12.661	0.4898
MSQ 1	4.199	2.5718721	6.681	1.522
Difference	12.45	4.48	5.98	1.188



Graph-1 The effect of Brandt-daroff exercises administered by physiotherapist and teacher.



**Result:**

To compare the effect of Brandt-daroff exercises administered by the therapist and teacher can be explained by the following results. For MSQ-0 of all the 31 students equal variance was not assumed as Levene's test was significant ( $<0.05$ ). So, equal variance not assumed was (0.016) which lead to implementation of ANCOVA testing. So, ANCOVA was applied using baseline (MSQ-0) as the covariant. The result of covariance suggests that the difference between the two testing is the result of 76% variance in the baseline (MSQ-0) score itself and 72% variance in the posttest (MSQ-1) score between the PT's and teacher's group, for 10 sessions. The sum of the variance is not 100% (76+72) as the effect of both the baseline variance and the exercises overlap.

The effect of the Brandt-daroff exercises administered by physiotherapist for group I Table 3 shows that the mean difference between MSQ-0 and MSQ-1 was 12.449, with standard deviation of 4.48.

The effect of the Brandt-daroff exercises administered by teacher in group II for 10 sessions (MSQ-0 to MSQ-1) had mean difference of 5.98 with the standard deviation of 1.188.

**Discussion:**

The concept of habituation exercises is that the repeated exposure to a provocative stimulus will result in a reduction in the pathological response to that treatment. The Brandt-daroff exercises are the type of habituation exercises. These exercises are based on the following concepts.

- One explanation is that the debris becomes dislodged from the cupula of the posterior SCC and moves to a location that no longer affects the cupula during head movement.
- A second possibility is that the debris dissolves in the endolymph, much like a lump of sugar dissolves with stirring.



- A third possibility is that central adaptation occurs, reducing the nervous system response to the signal from the posterior canal.

The effect of Brandt- Daroff exercises on vestibular dysfunction in hearing impaired children administered by physiotherapist (Group I) is significant by 74.77% suggesting the improvement occurs because of the habituation of the vestibular system to the provoking symptoms in the positions of the Brandt-daroff exercises. In testing of the motion sensitivity, out of sixteen positions maximum intensity of provoked symptoms was observed in Hall Pike Dix test followed by Roll's test and head tipping positions. Post test scoring showed maximum improvement in Hall-Pike Dix and Roll's positions.

The administration of the Brandt-daroff exercises by teacher (Group II) also had significant improvement with 52.8% in the vestibular symptoms in hearing impaired children. But the improvement seen in group II was less than that of group I. The effect of the vestibular symptoms was the combination of effect of Brandt-daroff exercise as well as the effect of non-homogeneity. The teacher's compatibility with the students was less when it came to administering exercises.

The Brandt-daroff technique is relatively easier than Liberatory Maneuver, Canalith Repositioning procedure, etc.; there is no need of any laboratory investigations or identification of liberatory Nystagmus or pathological side identification. The hearing impaired children attend schools daily, so these exercises can be easily administered and executed by teacher.<sup>8</sup> Moreover as the prevalence of vestibular dysfunction is approximately 90% in hearing impaired children this exercise will be helpful in improving their vestibular symptoms during their routine.<sup>10</sup> Brandt-daroff can be used as the prophylactic treatment to treat further episodes of the dizziness.<sup>11</sup> So, this can be practiced regularly and incorporated in their regular schedules of the physical sessions. Moreover, practicing each cycle will take 1 to 1.5 minute hence the whole sessions will take less than 5 minutes. So these exercises are time saving, done without any equipment and totally cost effective. Group therapy can be administered to ensure the completion of task with enthusiasm due to peer participation. Thus, the exercise will not remain mere exercise it will become a part of play therapy. Hence Brandt-daroff exercise improves vestibular dysfunction in hearing impaired children with fun.

### **Conclusion:**

The study concluded that the treatment protocol of Brandt-daroff exercises reduced the vestibular dysfunction in hearing impaired children. The exercises administered by physiotherapist were more effective. However the exercise can be administered by teacher or can be given as the group therapy.

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