EFFECT OF VESTIBULAR TELEREHABILITATION ON MOTION SICKNESS IN HEALTHY INDIVIDUALS- A RANDOMIZED CONTROLLED TRIAL

Dissertation Submitted to the

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PRIYANKA NAHAK

In Partial fulfilment of the requirements for the degree of

MASTER OF PHYSIOTHERAPY (M.P.T)

In

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Under the guidance of

DR. SONALI SOUMYASHREE

ASSISTANT PROFESSOR

ABSMARI

ABHINAV BINDRA SPORTS MEDICINE & RESEARCH INSTITUTE

Bhubaneswar, Odisha

2021-2023

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Place: ODISHA DR. Sonali Soumyashree

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Date: Signature

Place : Odisha Name : Priyanka Nahak

LIST OF ABBREVIATIONS

1. **ABSMARI –** Abhinav Bindra Sports Medicine and Research Institute
2. **BMI –** Body Mass Index
3. **IQ-** Interquartile Range
4. **MISC-** Misery Scale
5. **MSAQ-** Motion Sickness Assessment Questionnaire
6. **MSQ-** Motion Sensitivity Quotient
7. **MST-** Motion sensitivity test
8. **SD-** Standard Deviation
9. **SEC-** Seconds
10. **SPSS –** Statistical package for social science
11. **VTR-** Vestibular Telerehabilitation

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ABSTRACT

EFFECT OF VESTIBULAR TELEREHABILITATION ON REDUCING MOTION SICKNESS IN HEATHY INDIVIDUALS- A RANDOMIZED CONTROLLED TRIAL

Background- Motion sickness is a common phenomenon characterized by symptoms such as nausea, vomiting, and dizziness, often caused by sensory conflicts during motion exposure. Vestibular telerehabilitation, a form of remote therapy targeting the vestibular system, holds promise as an innovative approach in reducing motion sickness.

Objective of the study was to investigate if vestibular rehabilitation in a telegraphic mode would reduce motion sickness in healthy individuals

Methods- Forty two healthy individuals aged between 18-40 years were randomly assigned to Experimental group (Group A) (n=21) and control group (Group B) (n=21). Each training intervention consisted of 5 min session for single session and twice a day for 7 days in a week for 6 weeks. Motion sickness related symptoms were assessed before and after 6 weeks of intervention using Motion sickness Assessment Questionnaire, Misery Scale, and Motion Sensitivity Quotient

Results– The current study demonstrated that in 6 week of vestibular telerehabilitation and diaphragmatic breathing exercise motion sickness has significantly reduced ($p<0.05$) in both Group A and Group B. The between group analysis revealed that Group A showed significant improvement ($p<0.05$) in the reduction of motion sickness than Group B in MISC and MSAQ. But no improvement was seen in MSQ($p>0.05$)

Conclusion-

The study concluded that Vestibular Telerehabilitation is an effective measure in reducing motion sickness compared to diaphragmatic breathing exercise.

Key Word- Healthy Adults, Motion Sickness, Telerehabilitation, Vestibular Rehabilitation

INTRODUCTION

Motion sickness is defined as a syndrome characterized by head reeling, nausea, and vomiting elicited in healthy individuals due to ongoing passive self-motion. Motion sickness can be of various types like carsickness, seasickness, and airsickness. It can be induced normally by stimulation and 3-D cinemas[1]**.** The main symptoms of motion sickness are nausea, vomiting, pallor, sweating, hypersalivation stomach awareness along with drowsiness, lethargy, and persistent fatigue which are together referred to as sopite syndrome[2]

As much as 60% of the population is believed to have some motion intolerance. Motion sickness affects nearly one-third of all people who travel by land, sea, or air. The visual-vestibular conflict begins in childhood and persists into adulthood resulting in sub-clinical chronic motion sensitivity[32]

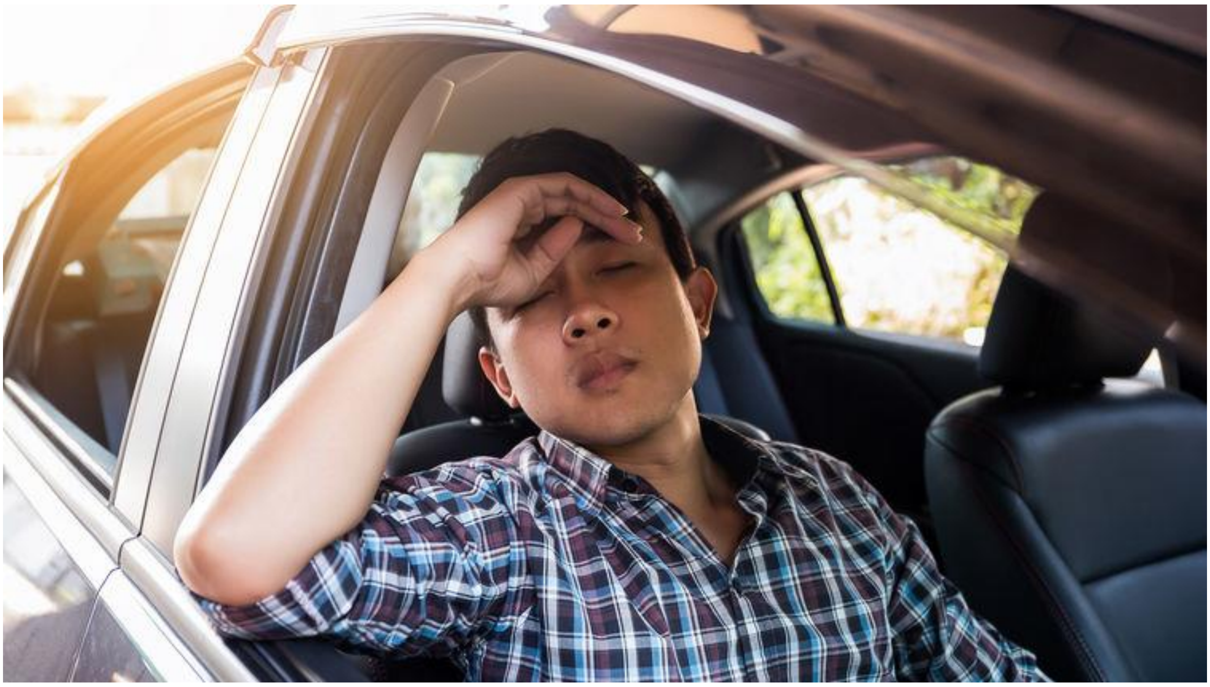

Fig- 1.1 Motion sickness symptom

https://www.google.com/url?sa=i&url=https%3A%2F%2Fnews.llu.edu%2Fpatient-care%2Fcar-sickness-driving-you-up-wall&psig=AOvVaw0aG4e57T9iB-zuWWmHdDDc&ust=1692196279212000&source=images&cd=vfe&opi=89978449&ved=0CBAQjRxqFwoTCIiausfw3oADFQAAAAAdAAAAABAO

Motion sickness is mostly prevalent among females [22]. However, the studies found the prevalence to be common amongst both the gender, motion sickness is widely related to oral contraceptives, pregnancy, menstruation, and cortisol level [12]

Fig- 1.2 Motion sickness symptom

https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.rac.co.uk%2Fdrive%2Fadvice%2Fhow-to%2Fhow-to-treat-and-prevent-motion-sickness%2F&psig=AOvVaw0aG4e57T9iB-zuWWmHdDDc&ust=1692196279212000&source=images&cd=vfe&opi=89978449&ved=0CBIQjhxqFwoTCIiausfw3oADFQAAAAAdAAAAABAE

The sensory conflict theory by Reason and Brand has explained the mechanism of motion sickness. As per his theory motion sickness originates due to a conflict between the actual vestibular system and expected patterns of visual, vestibular, and somatosensory inputs.[3] It has been found that the vestibular system influences the occurrence of motion sickness as individuals with bilateral vestibular deficit do not show any signs of motion sickness with provocative stimuli.[4] Any physical or apparent motion that is non-adaptive to the human nervous system can cause abnormal activation of vestibulo autonomic pathways resulting in motion sickness[11]

Previous studies have reported that repeated exposure to challenging motion can reduce the occurrence of motion sickness. The tolerance capacity of an individual to suppress motion sickness is known as susceptibility and this depends on three major properties of the vestibular system that is receptivity, adaptability, and retentivity.[7] The labyrinth in the inner ear is the major organ for the peripheral vestibular system. it contains 3 semi-circular canals and 2 otolith organs that detect head motion to maintain balance and equilibrium.[4] These organs contain receptor hair cells which get activated by the movement of endolymph due to the movement of the head and generate an action potential in the 8th cranial nerve. The semicircular canal responds to angular head movement and otolith organs to the linear movement and static head position[4]

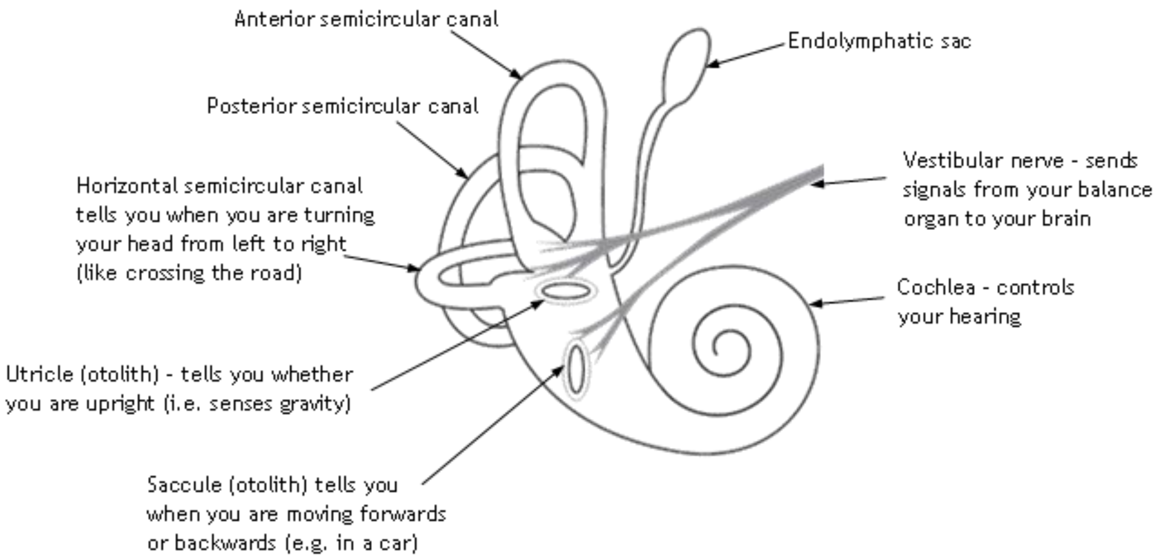

Fig-1.3 Anatomy of inner ear

https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.menieres.org.uk%2Finformation-and-support%2Fthe-ear&psig=AOvVaw1dPh83vxGPKlpOqIOVZU8m&ust=1692196693536000&source=images&cd=vfe&opi=89978449&ved=0CBMQ3YkBahcKEwiAjLaI8t6AAxUAAAAAHQAAAAAQBA

The vestibular system functions by various mechanisms, one among which is the vestibular ocular reflex. Failure to adapt to this reflex may cause visual vestibular mismatch and result in motion sickness. The semi-circular canal and otolith organs have specialized gravitational senses for sensing angular and linear head movements. The information from these organs helps in stabilizing the gaze during head motion (VOR)[9]

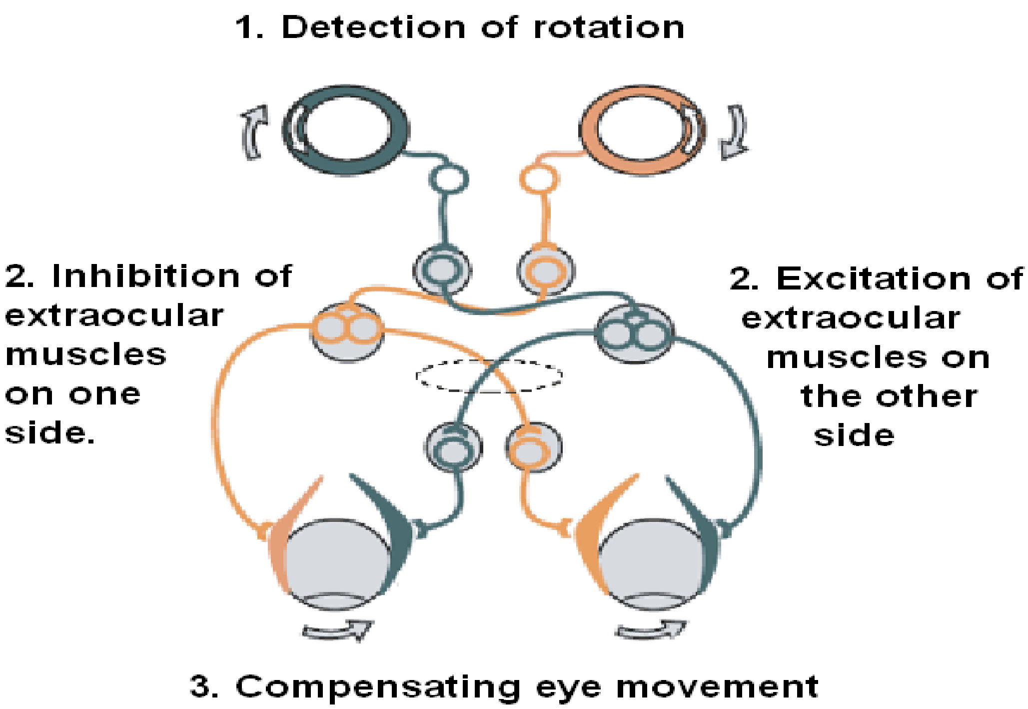

Fig-1.4 Vestibulo Ocular Reflex

https://www.google.com/url?sa=i&url=https%3A%2F%2Fen.wikipedia.org%2Fwiki%2FVestibulo%25E2%2580%2593ocular_reflex&psig=AOvVaw0QU_ZjcGqxvTzyn_P0mAjX&ust=1692196929308000&source=images&cd=vfe&opi=89978449&ved=0CBIQjhxqFwoTCNCdhvny3oADFQAAAAAdAAAAABAE

NTS plays an important role in relaying labyrinthine signals to the emesis pattern generator. Early lesion studies suggested that the area postrema chemoreceptive trigger zone was essential for eliciting vomiting during motion sickness nausea and vomiting. More recent lesion experiments, however, showed that motion-induced vomiting was prevented only in those cases where the area postrema lesions also extended into the underlying NTS. [8] A study by Daunton and Fox revealed that visual stimuli are provocative at a slower speed which is 60 degrees per second and vestibular stimuli are provocative at a higher speed at 150 degrees per second [10]

Motion sickness can be treated by pharmacological, behavioural, Physical therapy, and Nutritional. Pharmacological treatment includes H1 antihistamines, anticholinergic, and antiemetics. All medications have had potential side effects such as drowsiness, inattentiveness, depression, decreased cognitive and motor skills, and they cannot be used in some industries or occupations. Long-term use of many of the drugs currently used to treat motion sickness or dizziness may also delay central compensatory capacities have also been demonstrated that the rate of habituation is slowed, indicating that if the central nervous system is not challenged by disruption of normal activation, it does not produce the compensatory reactions that result in habituation.[15]The non-pharmacological intervention include autogenic feedback training, habituation exercises, mental imagery, nutritional and behavioral measures, plant-based intervention, music therapy, breathing exercises, an Odor treatment.[12]

Vestibular rehabilitation has been widely used in the literature on motion sickness. Vestibular rehabilitation uses central mechanisms of neuroplasticity (adaptation, habituation, and substitution) to increase static and dynamic postural stability and to improve visuovestibular interactions [27.] It mainly works by adapting the vestibulo ocular reflex and habituating the person to the provocating stimulus. Habituation includes repeated exposure of the subject to the stimulus and gradually learning to control the symptoms [13]. Previous studies have focused on vestibular rehabilitation to cure symptoms and motion sickness and found effective [10, 15,16]

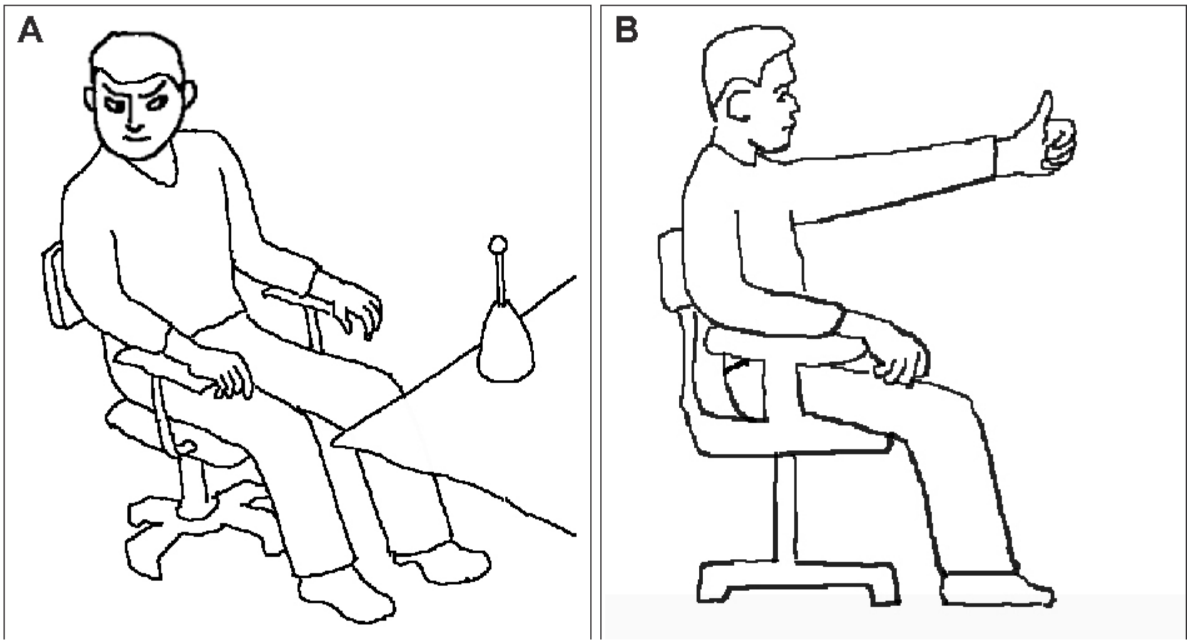

Fig-1.5 Vestibular Rehabilitation

https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.semanticscholar
.org%2Fpaper%2FVestibular-Rehabilitation-Therapy%253A-Review-of-and-
Han-
Song%2Ff2cd7baec276b01c330a29c28dea0fbbf6e93b9e&psig=AOvVaw3HpSp
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&ust=1692197236201000&source=images&cd=vfe&opi=89978449&ved=0CBIQj
hxqFwoTCOCd4Yr03oADFQAAAAAdAAAAABAE

Telerehabilitation is an emerging technology where rehabilitation is provided beyond the area of traditional healthcare facilities. This has bridged the physical, financial, and logistic gap in patient care delivery. Video-based telerehabilitation includes direct therapy sessions, consultation, disease monitoring, and patient and caregiver education irrespective of the distance [14]

The use of telerehabilitation has increased in recent times. Previous studies have given contradictory results on telerehabilitation. A study by Rosa Ortiz and Roberto Cano et al. found that telerehabilitation is effective in treating Multiple sclerosis patients [5]. Wherein a study by Steven Truijen et al. found that telerehabilitation can be used as an augmentation to conventional therapy in post-clinical rehabilitation [6]

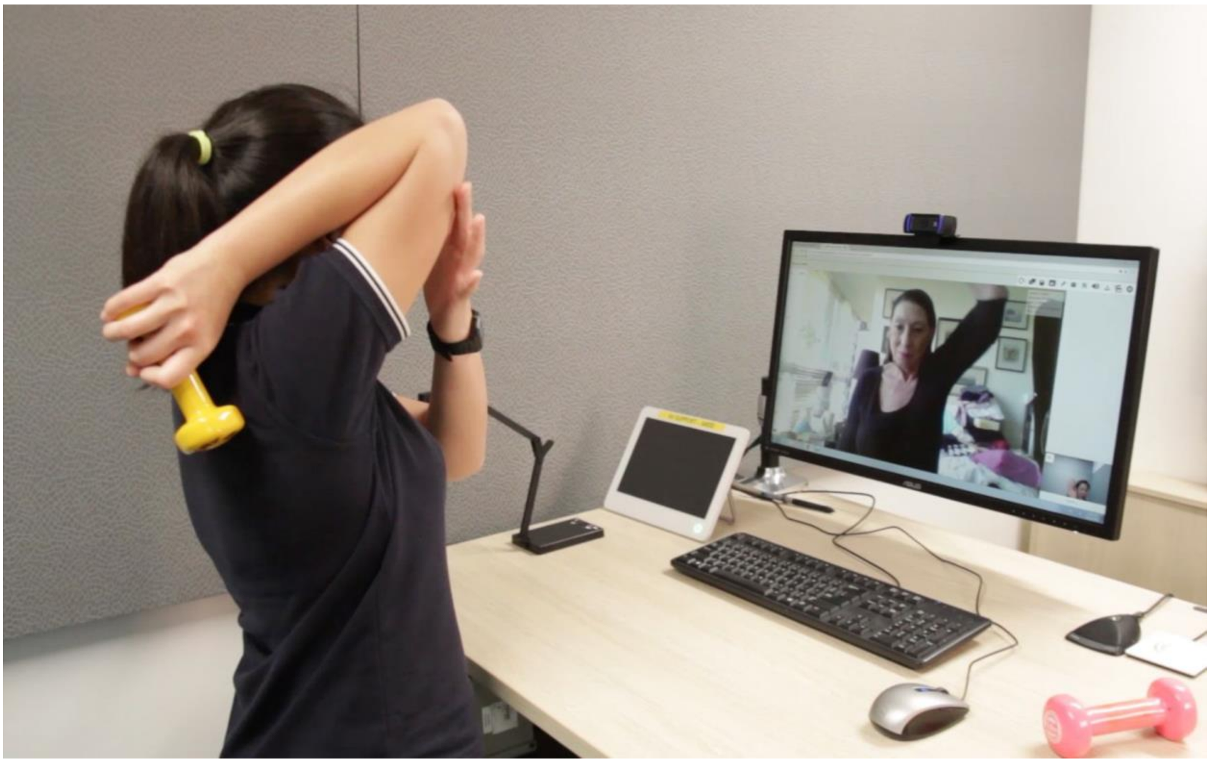


Fig-1.6 Telerehabilitation

https://www.google.com/url?sa=i&url=https%3A%2F%2Fshrs.uq.edu.au%2Farticle%2F2020%2F05%2Fwhy-telerehabilitation-so-important-during-covid-19-

pandemic&psig=AOvVaw2UUVdkGDKb-sINbwgyVJkU&ust=1692197325952000&source=images&cd=vfe&opi=89978449&ved=0CBIQjhxqFwoTCKiV1bb03oADFQAAAAAdAAAAABAE

Since telerehabilitation has been effective in treating patients and vestibular rehabilitation has been to be proven in motion sickness The purpose of this study was to find out if vestibular rehabilitation in a telegraphic mode would reduce symptoms of motion sickness in healthy individuals

Statement of Question

- Is there any significant effect of vestibular telerehabilitation on reducing motion sickness in healthy individuals?

Need of the study

- Motion sickness is a common phenomenon that affects healthy adults' quality of life and is often ignored.
- Vestibular rehabilitation has been found to address the symptoms of motion sickness but evidence still lacks regarding any specific protocol. Vestibular telerehabilitation has not yet been explored in reducing the symptoms of motion sickness.
- Lack of research in proving protocol that reduces the symptoms of motion sickness in healthy adults
- To promote self-management and self-efficacy by telerehabilitation

- There is very less evidence for rehabilitation in motion sickness

AIM

- To find the effectiveness of vestibular telerehabilitation on reducing motion sickness
- To find the effectiveness of Diaphragmatic along with slow paced breathing exercise on reducing motion sickness
- To Compare effects the Vestibular telerehabilitation and Diaphragmatic along with slow paced breathing exercise on reducing motion sickness

OBJECTIVE

- To find the effectiveness of vestibular telerehabilitation on reducing motion sickness in healthy individuals measured by using the Motion Sensitivity Quotient
- To find the effectiveness of vestibular telerehabilitation on reducing motion sickness in healthy individuals measured by using a Motion sickness assessment questionnaire
- To find the effectiveness of vestibular telerehabilitation on reducing motion sickness in healthy individuals measured by using the Misery scale

Hypothesis

Null Hypothesis

H_{01}: There is no significant effect of vestibular telerehabilitation on reducing motion sickness in healthy individuals

Alternating hypothesis

H_{11}: There is a significant effect of vestibular telerehabilitation on reducing motion sickness in healthy individuals

REVIEW OF LITERATURE

1. **EmelUgur et al.(2022)** in the journal of Auris Nasus Larynx conducted a study on"The potential use of virtual reality in vestibular rehabilitation of motion sickness in Turkey." It was a randomized controlled trial where 20 normal and 19 Motion sickness patients were included out of which 22 were females and 17 were males between 18-40 years, virtual reality-based vestibular rehabilitation was given for a total of 6 sessions either for 2 times a week for 3 weeks or 3 times a week for 2 weeks. Pre and post-outcomes were taken using sensory organization tests. Pre outcomes that are 1st and 2nd SOT are taken before commencing virtual reality treatment and 3rd and 4th SOT is taken after the 3rd and 6th session of virtual reality treatment respectively. The result found that the patient group was statistically significantly higher than the control group. This Study concluded that virtual reality is proven to be significantly effective for motion sickness

2. **A.C. Paillard et al. (2013)** conducted a study on Motion sickness susceptibility in healthy subjects and vestibular patients: Effects of gender, age, and trait-anxiety where 167 healthy subjects and 94 patients with chronic peripheral and central vestibulopathy were included in the study. Patient samples were further

divided into vestibular loss and nonvestibular loss according to the bithermalcaloric and rotating-chair tests performed by video nystagmography. The VL subgroups regrouped patients presenting unilateral (21 women and 21 men) or bilateral vestibular losses (5 women and 4 men) and NBL group into 19 males and 24 females out of which patients with BPPV 11 females and 17 males, vestibular migraine 13 females and 1 male. MSS was assessed using fMSSQ Short-form and French versions of the STAI-B questionnaire. Patients with vestibular loss reported lower MSS than healthy subjects, whereas vestibular patients without vestibular loss reported higher MSS than healthy subjects. The higher MSS in vestibular patients without a vestibular loss (nVL), in particular for vestibular migraine, MSS is higher for females than males, and MSS is higher before 12 years than in adulthood. MSS is the peak for females compared with males at 50–60 years old. MSS declines across adulthood and women present greater MSS than men at all ages. They showed a higher female MSS compared to males up to 40 years old but then no gender difference from subjects older than 40 years old. They concluded that there is a reduction in MSS in patients with vestibular loss compared to healthy subjects and patients without vestibular loss reported elevated MSS compared with healthy. These significant differences could not be explained by gender, age, trait anxiety, or interactions

3. **Shilpa B. Gaikwad et al.(2018)** conducted a study on the Effect of Gaze Stability Exercises on Chronic Motion Sensitivity: Single blinded Randomized Controlled Trial in which 41 participants aged between 20-40 years with self-reported history of chronic motion insensitivity were recruited for the study. 21 were included in the intervention group and 20 were included in the sham

group. The intervention group performed gaze stability exercises using a hand-held or wall-mounted exercise card and the sham group was doing saccadic eye movements for 6 weeks. Outcome measures were Computerized Dynamic Posturography with Immersion Virtual Reality, MSQ, Motion Sickness Sensitivity Susceptibility Questionnaire Short Form, and State-Trait Anxiety Inventory for Adults. Postural stability was performed on Two platforms that are on fixed support and sway reference support and in both conditions, visual flow was independent of participants’ sway. This study concluded that both groups demonstrated significant improvements in postural stability during CDP-IVR C2, and there was a significant difference between the intervention group and the sham group which suggests that progressive gaze stability exercises had a larger effect than saccadic eye movement. The experimental group reported a greater reduction in the perception of motion sensitivity.

4. **Matthew Edward Brannon Russell et al.(2014)** conducted a study on the Use of Controlled Diaphragmatic Breathing for the Management of Motion Sickness in a Virtual Reality Environment where 60 healthy subjects were randomly assigned to experimental and control groups out of which six males and 25 females were included in the experimental group and participants six males and 23 females were included in the control group. For the motion sickness experience, participants wore a 3D head-mounted goggle set with over-the-ear headphones for a total of 10 min at a frequency of 0.643 HZ. While heart rate variability, breathing rate (RPM), and motion sickness ratings were collected post-virtual reality experience. The experimental group is given paced diaphragmatic exercise at least 3-7 times per minute and the control group is given with the instruction of environmental awareness. Following this,

participants were exposed to virtual reality (VR) motion sickness experience, while heart rate variability, breathing rate (RPM), and motion sickness ratings were collected. Results demonstrated participants in the DB condition had higher PNS activation and reported fewer motion sickness symptoms during the VR experience than the participants in the control condition. The conclusion suggests that the DB protocol can be used to significantly increase PNS tone and decrease the development of motion sickness symptoms

5. **Vincent A van Vugt et al.(2019)** conducted a study on Internet-based vestibular rehabilitation with and without physiotherapy support for adults aged 50 and older with a chronic vestibular syndrome in general practice: Pragmatic, three-armed, parallel-group, individually randomized controlled trial where 322 adults aged 50 and older with a chronic vestibular syndrome. Patients were divided into 3 groups that are 98 patients for stand-alone, 120 for usual care, and 104 for blended rehabilitation. Stand-alone VR comprises a six-week, internet-based intervention with weekly online sessions and daily exercises (10-20 minutes a day). In the blended VR group, the same internet-based intervention was given along with face-to-face physiotherapy for home visits in weeks 1 and 3. Participants in the usual care group received standard care. Primary outcome measures by vertigo symptom scale short form and secondary outcome measures by dizziness-related impairment, anxiety, depressive symptoms, subjective improvement of vestibular symptoms after three and six months, and adverse events. Results found that participants in the stand-alone and blended VR groups had lower VSS-SF scores at six months than participants in the usual care group. Participants in the stand-alone and blended VR groups also experienced less dizziness-related

impairment, less anxiety, and more subjective improvement of vestibular symptoms at three and six months Stand alone and blended internet-based VR are clinically effective and safe interventions to treat adults aged 50 and older with a chronic vestibular syndrome. Online VR is an easily accessible form of treatment.

6. **Arturo Nuara et al.(2022)** conducted a study on Telerehabilitation in response to constrained physical distance: an opportunity to rethink neurorehabilitative routines. The objective of this study was to find the benefits of telerehabilitation, by removing physical distancing barriers in neurorehabilitation. The effectiveness of telerehabilitation can be improved by several technologies available to date like virtual reality which can recreate realistic environments which allow to quantitative monitor the patient's performance, and signal processing may contribute to the prediction of long-term dynamics of patient recovery. Telerehabilitation has benefits far beyond the mere limitation of physical distancing effects, mitigating criticalities of daily neurorehabilitative practice, and thus paving the way for mixed models of care, where hospital-based procedures are complementarily integrated with telerehabilitation ones. This study concluded that telerehabilitation represents the only valuable and scalable solution in case of constrained and persistent social distance requirements, making the patients perform in a virtual environment while remotely interacting with clinicians

7. **CharlotteDe Vestel et al.(2022)** conducted a study on How do patients with chronic dizziness experience a web-based home rehabilitation program for customized vestibular therapy ('WeBaVeR')? A qualitative study in Belgium in which 12 patients aged from 23 to 65 years with chronic dizziness participated

in this study and they were provided with 7 times a week for 6 weeks of the WeBaVer program was given to the patients. The exercise program was customized vestibular rehabilitation which comprised gaze stabilization, balance, movement habituation, visual desensitization neck exercises. Outcomes were DHI, VVAS, Static balance test, and functional gait assessment. This study concluded that WeBaVer is considered a useful and acceptable satisfactory and quality therapy method for chronic dizziness

8. **Rose Marie Rine et al.(1998)** conducted a study on Visual-Vestibular Habituation and Balance Training for Motion Sickness This case report was done to find the effectiveness of physical therapy for motion sickness in a 34-year-old woman. The purpose of the report was to provide an overview of the literature regarding motion sickness syndrome, causal factors, and rationale for treatment and to describe the evaluation and treatment of a patient with motion sickness. The patient initially had moderate to severe visually induced motion sickness, which affected her functional abilities and prevented her from working. Following 10 weeks of a primarily home-based program of visual vestibular habituation and balance training with a gradual increase in difficulty, to increase the patient's tolerance to visual stimulation, decrease somatosensory preference and dependence, and improve postural control, her symptoms were alleviated and she could resume all work-related activity.

9. **Khalid A. Alahmari,(2014)** conducted a study on the Comparison of Virtual Reality-Based Therapy With Customized Vestibular Physical Therapy for the Treatment of Vestibular Disorders where 38 subjects with peripheral, central, or mixed vestibular disorders were included in the study, out of which Twenty

subjects with vestibular disorders performed VRBT and 18 received standard PT which was given for 1 session for a week for a total of 6 sessions in 6 weeks. During the VRBT intervention, subjects were asked to walk on a treadmill within an immersive virtual grocery store environment, for six sessions approximately one week apart. The PT intervention comprised gaze stability exercise which requires head movements, postural instability, and equilibrium, and walking exercises which are individually tailored. Pre and post outcomes were taken that is Before the intervention, one week after, and at six months after the intervention, subjects completed self-report and balance performance measures. In both VRBT and PT groups, significant improvements were found in the majority of self-report and performance measures one week after the intervention. In self-report measures activity-specific balance confidence scale, dizziness handicap inventory, Situational Characteristics Questionnaire, and in Performance Measures: DGI, FGA, TUG, SOT. Within-Session VRBT Symptoms like nausea, headache, dizziness, and visual blurring using a using VAS. This study concluded that there is no difference in outcomes between PT and VRBT

10. **Yoon-Hee Cha et al.(2021)** conducted a study on Motion sickness diagnostic criteria: Consensus document of the classification committee of the Barany Society where they found that the prevalence of motion sickness in childhood has been estimated at 35–43% prior to puberty and 25% in young adults 14% of adults younger than 30 years old and 7% of adults 61 years old or older. The prevalence of motion sickness susceptibility rises between the ages of 7–12 years and 713 declines thereafter and throughout adulthood. Susceptibility gradually continues to decline with age but may increase in a small proportion

of individuals and The evidence of sex differences in motion sickness is mixed. Only 50% of the studies in the literature have found women to be significantly more susceptible to motion sickness. Heritability for motion sickness (in women) shows a 0.69 concordance in monozygotic twins and 0.44 concordance in dizygotic twins for childhood motion sickness, yielding a heritability estimate of 70%.

11. **Patricia S. Cowings et al.(2000)** conducted a study on Autogenic-Feedback Training Exercise Is Superior to Promethazine for Control of Motion Sickness Symptoms. The aim of this paper was to compare the effectiveness of three interventions for motion sickness and are intramuscular injections of promethazine, a physiological training method autogenic feedback training exercise, and no-treatment control. In this study, they compared the motion sickness tolerance, symptom reports, and physiological responses of the subject's database who received either Promethazine, AFTE, or no treatment. They had taken 33 men between the age group of 33-40 years and divided them into 3 groups with each group having 11 participants and they were matched with the number of rotations tolerated during their initial rotating-chair motion sickness test. The motion sickness test procedures and the 7-day interval between tests for 4 consecutive weeks were the same for all subjects. The drug group was tested under four treatment conditions: baseline (no injections), a 25 mg dose of promethazine, a 50 mg dose of promethazine, and a placebo of sterile saline. AFTE subjects were given four 30-minute AFTE sessions before their second, third, and fourth motion sickness tests total of 6 hours. The no-treatment control subjects were only given the four rotating-chair tests. Motion sickness tolerance was significantly increased after 4 hours

of AFTE when compared with either 25 mg or 50 mg of promethazine. The control and promethazine groups did not differ. AFTE subjects reported fewer or no symptoms at higher rotational velocities than subjects in the control or promethazine groups. This study concluded that, AFTE produces greater resistance to motion sickness than IM promethazine which in turn strongly suggest that it is a superior intervention for terrestrial motion sickness and may also provide better protection from motion sickness in space

12. **Reyyan Haciabbasoglu et al.(2023)** conducted a study on Are Telerehabilitation Exercise Practices Effective in Patients Diagnosed with Benign Paroxysmal Positional Vertigo? Where they had taken 42 patients and divided them into 21 for the experimental and 21 for the control group. The purpose of this study was to compare the effectiveness of classical Vestibular Rehabilitation Exercises which were given as a home exercise program for the control group and VR and balance exercises given with Telerehabilitation for the Experimental Group. This was a pre-post-experimental design study. The outcome measures for balance ability were Romberg, tandem and semi-tandem tests, for Vertigo severity Vertigo Symptom Scale-VSS, VAS, and DHI is used for Vertigo related disability level, for Anxiety BAI and For Quality-of-life assessment Vertigo Dizziness Imbalance Questionnaire-VDI were used. Results for the balance ability found significantly increased in the tandem and semi-tandem tests for EG compared to CG. The severity of dizziness reduced significantly in the EG compared to the CG according to the VAS scale, Symptoms of vertigo were decreased significantly in the EG compared to the CG according to DHI. A considerable improvement was seen in the quality of life of the EG group compared to CG according to VDI scoring. They

concluded that the applicability of Telerehabilitation in BPPV patients in evaluation, diagnosis, treatment, and rehabilitation processes by optimizing time, space, and cost and EG applications are effective and clinically applicable in patients with BPPV

METHODOLOGY

- STUDY DESIGN – Randomized controlled trial
- STUDY POPULATION – Healthy individuals with complaint of motion sickness
- SAMPLE SIZE – 42

  (*The sample size was calculated by using G power)
- SAMPLING TECHNIQUE – Random Sampling
- SAMPLE DESIGN- Probability Sampling
- STUDY SETTING – Home setting
- STUDY DURATION – 6-8 months

SELECTION CRITERIA

Inclusion criteria:

- Age-18-40 years [16]
- Gender- Male and female
- Willing to participate in the study
- Individual who complaint of motion sickness symptoms
- Individual who had access to internet-based smart devices like smartphones, tablet, or laptop

Exclusion criteria

- Participants with acute or chronic vestibular pathology
- Participants with a history of ear operation
- Participants with any other neurological involvement
- Participants who showed positive for the fukuda test
- Patients who were on anti-motion sickness medication

Termination Criteria

- Severe headache

- Shortness of breath
- Subject requests to stop
- Physical or verbal manifestations of severe fatigue.

Materials used:

Laptop

Mobile

Questionnaire

Chair

Couch

Measuring tape

Stopwatch

Scoring sheet

SAMPLE SIZE ESTIMATION

A sample size of 42 subjects was estimated using a larger effect size 0.80, a power of 0.80, and a level of significance set at 0.05. Participants were randomly assigned to either the intervention or Control group

OUTCOME MEASURES

PRIMARY OUTCOME MEASURE

Motion Sensitivity Quotient

SECONDARY OUTCOME MEASURE

Motion Sickness Assessment Questionnaire

Misery Scale

Sample selection and screening:

A sample of 42 subjects, who met the inclusion and exclusion criteria, were recruited from different states of India. Written informed consent was obtained from the subjects. Demographic data was taken and a detailed examination was done. The subjects were then randomly allocated into the following two groups by computer-generated random number tables.

- Group 1 (Experimental group) were given the vestibular telerehabilitation technique
- Group 2 (Control group) were given Diaphragmatic breathing along with slow paced breathing exercises in telegraphic mode.

Procedure

- The study was approved by the institutional research review committee and the institutional ethical committee. A sample of 42 subjects with motion sickness were taken. All subjects were given a detailed explanation of the procedure and written informed consent was obtained. Demographic data of the subjects was collected and baseline assessment was performed. The subjects were then randomly allocated into the following two groups by computer-generated random numbers and tables:
- Group 1 (VTR group) was given Vestibular Telerehabilitation
- Group 2 (Control group) was given Diaphragmatic and slow-paced breathing exercise
- Both groups continued their regular training program throughout the study.

- Intervention was given for 5 min per session for twice a day, 7 days a week for 6 weeks.

Procedure for Vestibular Telerehabilitation [21]

The subject is asked to sit on the chair in front of his mobile, desktop, or laptop and instructed to follow the command of the clinician

1. Exercise 1- Shake: - The subject turned his head from right to left and back again and had to do it 10 times in 10 seconds then had to twist the head around as far as it went comfortably and while the subject was performing this test subject had to look in the direction where the head was pointing. The subject had to wait for 10 seconds after he had performed 10 complete turns and then had to do it for 10 more turns in the next 10 sec
2. Exercise 2- Nod: - The subject had to nod his head up and down and back again 10 times in 10 sec and then the subject tipped his head as far as it went comfortably while performing this test the subject had to look in the direction where the head was pointing. The subject had to wait for 10 seconds after he had performed 10 complete turns and then had to do it for 10 more turns in the next 10 sec
3. Exercise 3- Shake with eyes closed: - The subject had to carry out the shaking exercise with his eyes closed and had to wait for 10 seconds after completion of 10 complete turns, and then had to perform 10 more turns in the next 10 seconds
4. Exercise 4- Nod with eyes closed: - The subject had to carry out the nod exercise with his eyes closed and had to wait 10 seconds after the completion

of 10 complete turns, and then had to perform for 10 more turns in the next 10 seconds.

5. Exercise 5- Shake and stare: - The subject had to hold his finger pointing upwards in front of him and carried out the shake exercise while staring at his finger. He did not let his eyes move from his finger and had to wait 10 sec after the completion of 10 complete turns, and then had to do 10 more turns in the next 10 sec
6. Exercise 6- Nod and stare: - The subject had to hold his finger pointing sideward in front of him and carried out the nod exercise while staring at his finger. He did not let his eyes move from his finger and had to wait for 10 sec after completing of 10 complete turns, and then had to do 10 more turns in the next 10 sec

Procedure for Diaphragmatic and slow-paced breathing [18]

The instruction was given to the subject not to do anything which can increase the sense of discomfort while practicing breathing. To start the breathing exercises the subject was asked to rest in a comfortable position with the head centered, supported, and in the midline of the body, Closed eyes with smooth eyelids with lips apart, teeth apart, and tongue relaxed and the shoulders should be sloped and even with elbows bent, the hands were not touching to one another; knees are apart; and feet are pointing away from one another at a 45–90-degree angle.

Then the subjects were instructed to place their right hand just below the rib cage on top of the stomach and asked to exhale first to release air from the body, that was a complete, relaxed release where there was no holding.

When the subject's body was ready to take the next breath of air in, they were asked to let the stomach gently rise as they were pushing the stomach up. After a comfortable, normal breath, release the muscles and asked to let the air go. Then the subject was instructed to pause and rest for 5 sec before starting another breathing. Counting 1-2-3 while taking the breath in and 1-2-3 for breathing out and 5-sec rest was given before starting with the next breathing cycle. 3-7 breaths per minute for 5 min per session twice a day and 7 days per week for 6 weeks

The outcome measures were taken by the blinded accessor who were not aware about the study

MOTION SENSITIVITY QUOTIENT[25]

The motion sensitivity test is a clinical protocol designed to measure motion-provoked dizziness during a series of 16 quick changes to head or body positions. Subjects were instructed to indicate the onset and offset of dizziness that occurred in each position. The duration of dizziness was recorded with a stopwatch,

For 5s to 10s of dizziness- 1 point

For 11s to 30s of dizziness- 2 point

For >30 s of dizziness- 3 point

Once the duration was recorded for position the subjects were asked to rate the intensity verbally on a scale of 0-5

0= No symptoms

5= Severe Dizziness

The maximum raw score for each position is 8 so for 16 different positions it is 128

The motion Sensitivity Test Quotient was calculated by the following formula

MSQ = Intensity + Duration × (Number of Positions)/20.48

A quotient of 0 to 10 is considered mild, 11 to 30 is moderate, and 31 to 100 is severe

MSQ has been used as a treatment outcome measure to monitor the effectiveness of vestibular rehabilitation therapy. The Intra rater reliability of The MSQ is (ICC-0.98) and the inter-rater reliability is (ICC-0.96 and 0.98). The validity is found to be good

MOTION SICKNESS ASSESSMENT QUESTIONNAIRE[20]

Motion sickness assessment questionnaire is a widely used and valid instrument for assessing motion sickness. MSAQ can be used to assess as a multidimensional rather than unidimensional construct. Exploratory and confirmatory factor analyses of motion sickness descriptors were used to derive and verify four dimensions of motion sickness, which were defined as gastrointestinal, central, peripheral, and sopite-related. Total scores from the MSAQ correlated strongly with overall scores from the Pensacola Diagnostic Index ($r = 0.81$, $p < 0.001$) and the Nausea Profile ($r = 0.92$, $p < 0.001$).

The total score for MSAQ is 144. The overall motion sickness score is obtained by calculating the percentage of total points scored

(Sum of points from all the items/144)100

MISERY SCALE[31]

The MISC, an 11-point scale ranging from 0 to 10, takes into account that symptoms of nausea are generally preceded by symptoms of oculomotor and disorienting origin

The advantage of rating subjective misery is given by the fact that people may feel sick without ever reaching emesis. Subjective misery, therefore, gives a more sensitive measure of sickness. This is a great advantage, especially when studying small populations. This scale exploits the knowledge that nausea is generally preceded by other symptoms such as dizziness, headache, (cold) sweat, and stomach awareness, the latter symptoms varying among people in order of appearance and severity. It is equal to the MISC used and validated by Wertheim et al., with the exception that once nausea is experienced, a minimum MISC of 6 is rated instead of 5.

The following scores are given for the symptoms

No problems - 0

Uneasiness (no typical symptoms)- 1

Dizziness, warmth, headache, stomach awareness, sweating- (vague 2, slight 3, fairly 4, severe 5

Nausea - Slight 6, fairly 7, severe 8, (near) retching 9

Vomiting 10

Fig-1.7 Vestibular Telerehabilitation

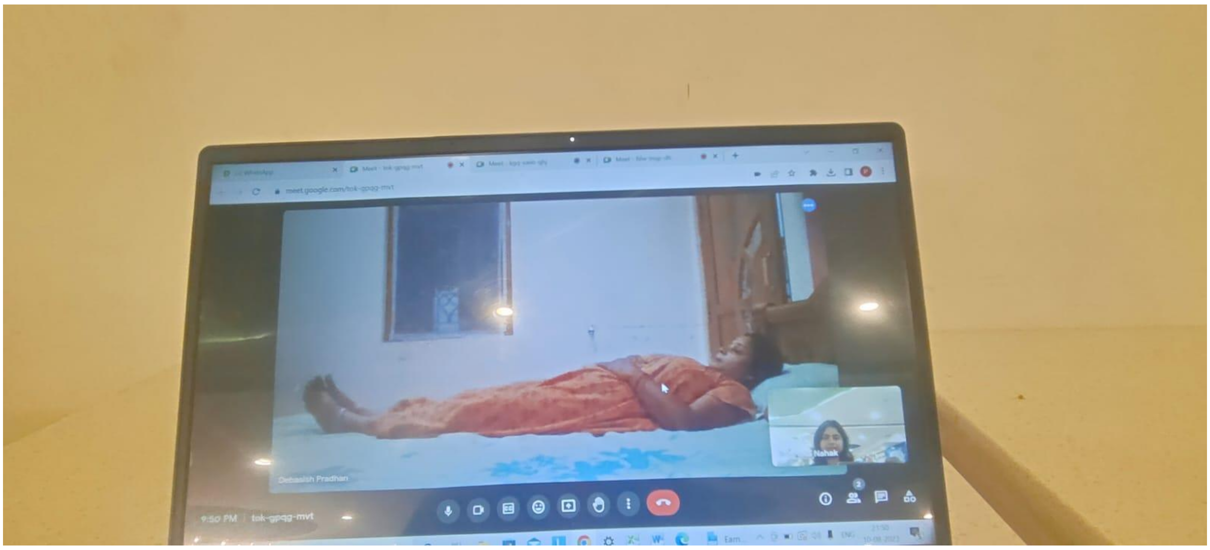


Fig-1.8

Diaphragmatic breathing exercise in telegraphic mode

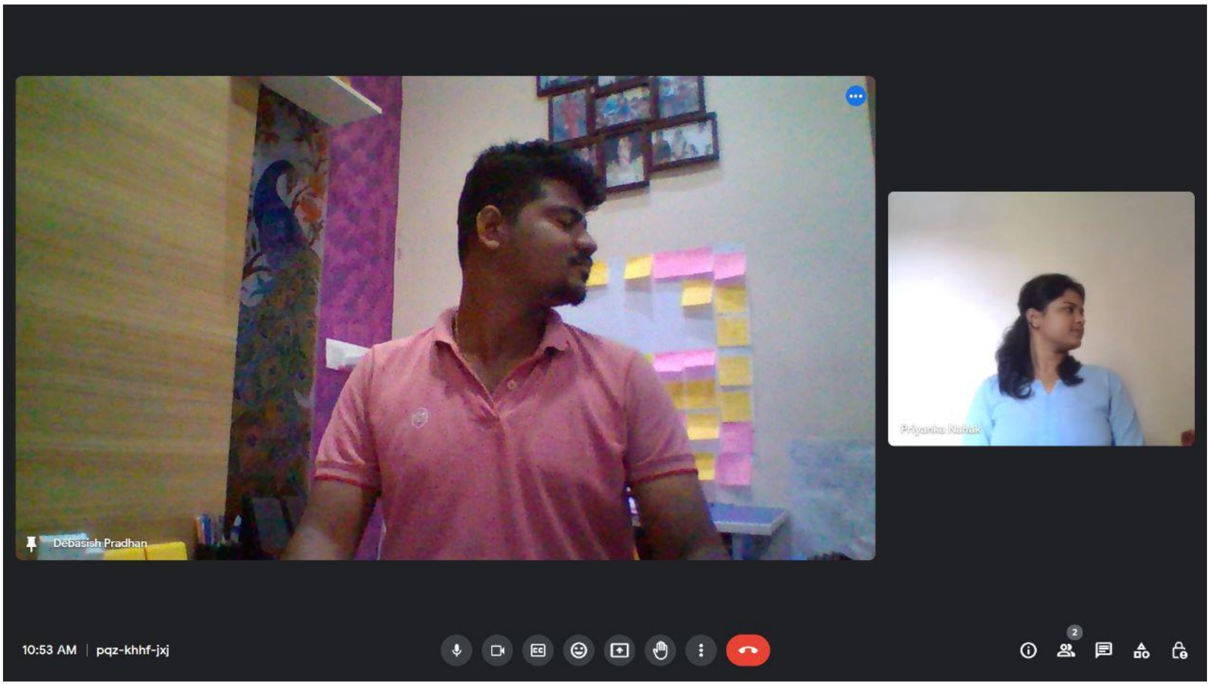
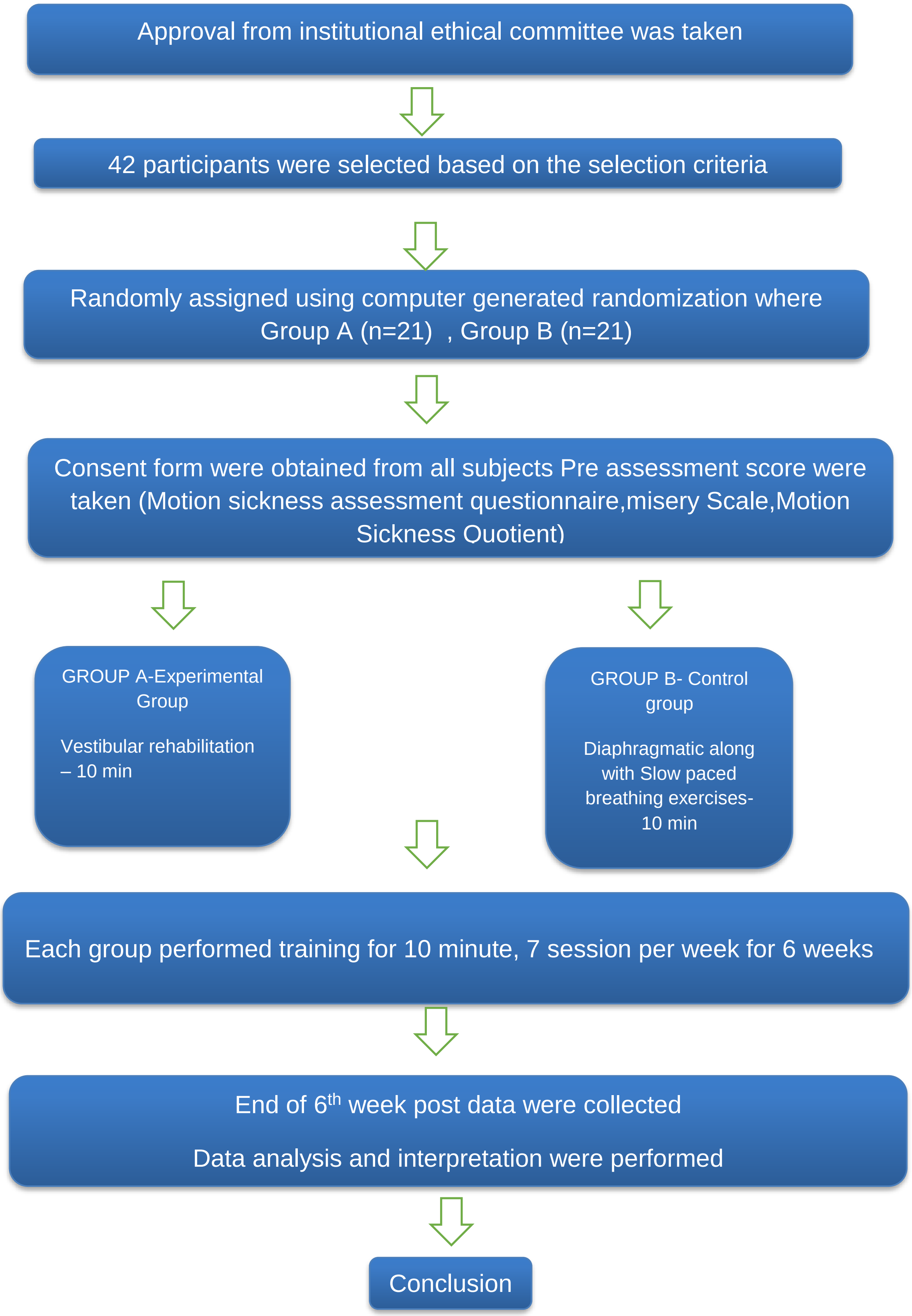


Fig- 1.9

Subject performing Shaking movement with eyes closed

Fig- 2.0 Subject performing Shaking movement with eyes open and fixed gaze

Fig -2.1 FLOW CHART



STATISTICAL ANALYSIS

Data was analyzed using the statistical package **SPSS 22.0** (SPSS Inc., Chicago, IL) and level of significance was set at **$p<0.05$**. Normality was taken out using **Shapiro Wilk Test**. Descriptive statistics was used to find out Mean and SD for parametric test, median and interquartile range for non parametric test.

Inferential statistics to find out the statistical difference within groups (pre and post-intervention) was done using **Paired t test** for normally distributed data and **Wilcoxon signed rank test** for not normally distributed data**.** Analysis for between groups (experimental and control) inferential statistics was done using **Mann-Whitney U test for** data not normality distributed and **Independent t test** for data normally distributed

TABLE 1.1.Mean Age Analysis

Group	Mean	SD
Experimental group	28.38	4.66
Control group	32.57	4.87

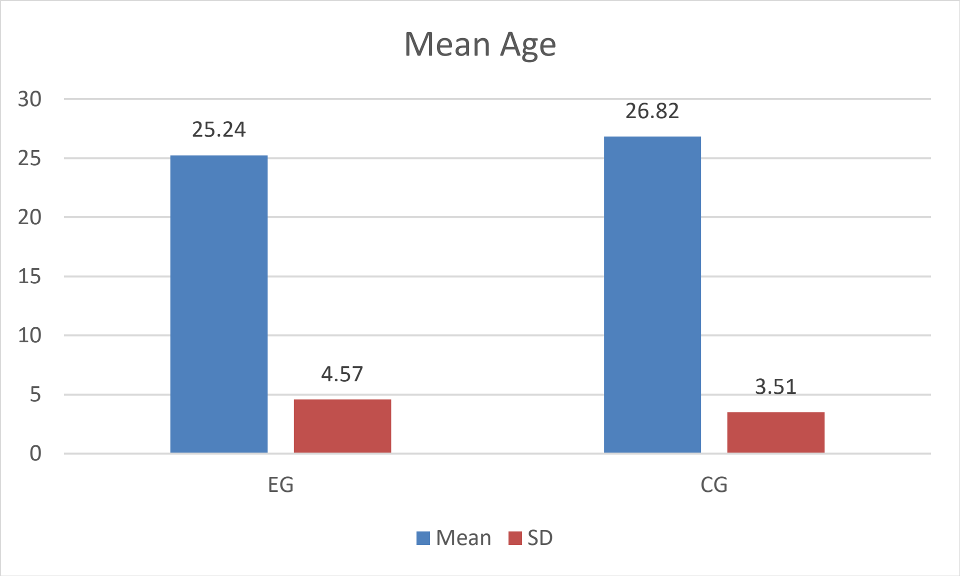


Fig- 2.2 Mean Age Analysis

TABLE 1.2.Mean BMI Analysis

Group	Mean	SD
Experimental group	25.24	4.57
Control group	26.82	3.51

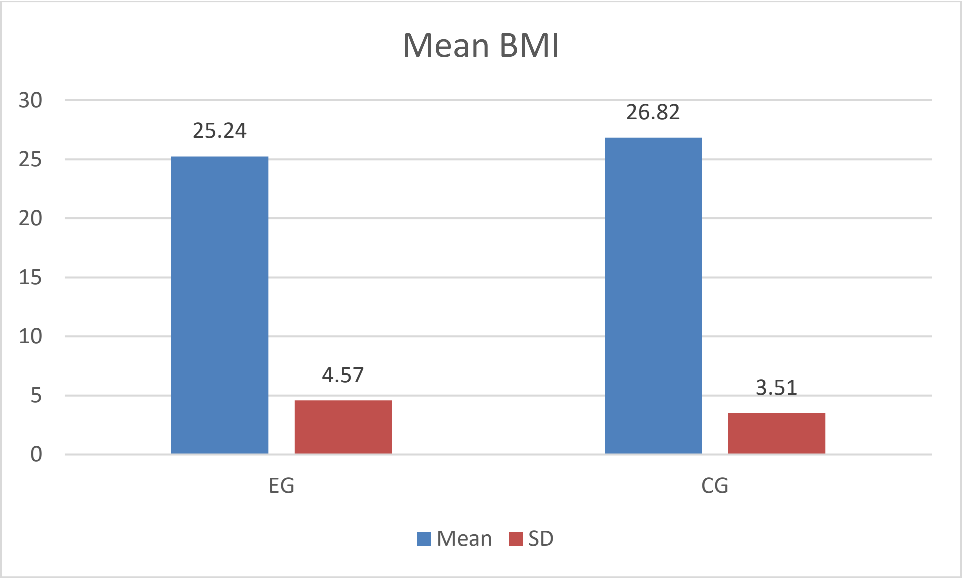


Fig- 2.3 Mean BMI Analysis

TABLE 1.3 MSAQ MEASURE FOR WITHIN GROUP ANALYSIS

MSAQ analysis with paired t test indicates statistically significant difference within the group in Vestibular Rehabilitation group ($p < 0.05$), Control group ($p<0.05$).The difference in mean value was reported as follows, experimental group > CON group

Group	Pre MSAQ	Post MSAQ	P value	Mean diff
Experimental Group	77.61 ±10.88	65.42 ±11.86	0.000	12.66
Control Group	73.28 ±7.97	61.90 ±8.37	0.000	11.38

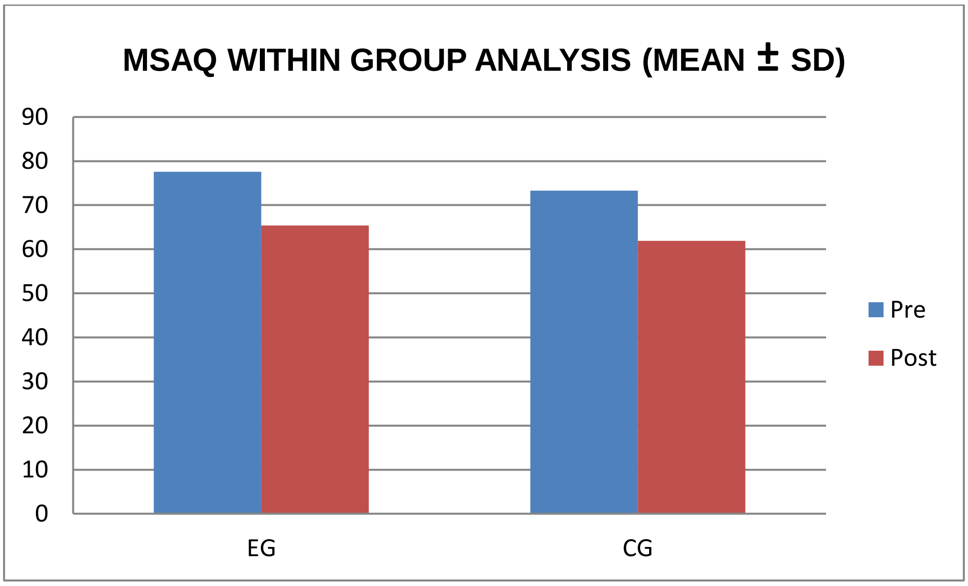


Fig 2.4 MSAQ MEASURE FOR WITHIN GROUP ANALYSIS

TABLE 1.4 MISC MEASURE FOR WITHIN-GROUP ANALYSIS

Misery Scale analysis with Wilcoxon signed rank test indicates a statistically significant difference within the group in Vestibular Rehabilitation group ($p < 0.05$), Control group ($p < 0.05$). The difference in mean value was reported as follows, experimental group > control group

Group	Pre MISC	Post MISC	P value	Mean diff
Experimental Group	8 ±2.5	6 ±2	0.001	2
Control Group	7 ±2	6 ±2	0.001	1

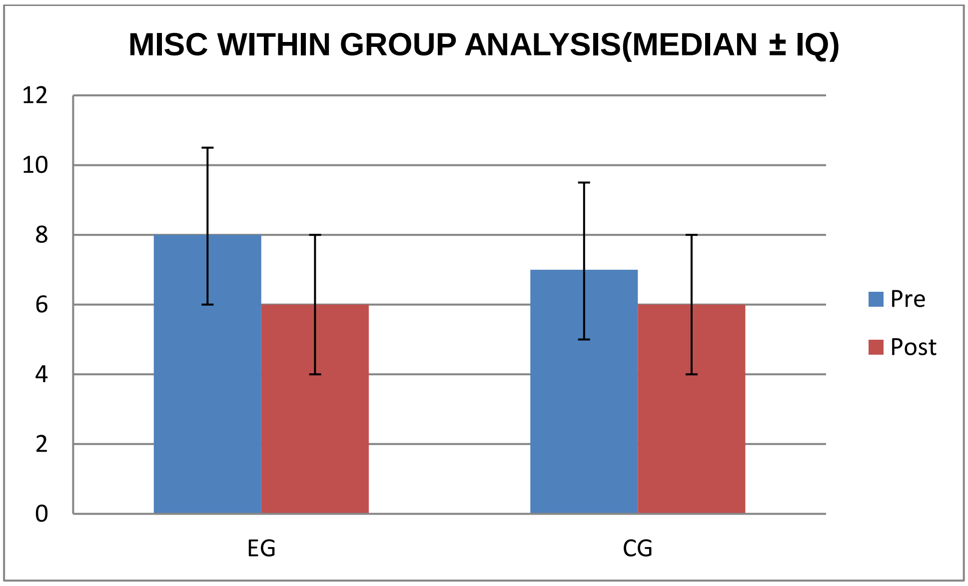


Fig 2.5 MISC MEASURE FOR WITHIN-GROUP ANALYSIS

TABLE 1.5 MSQ MEASURE FOR WITHIN GROUP ANALYSIS

MSQ analysis with paired t test indicates statistically significant difference within the group in Vestibular Rehabilitation group ($p < 0.05$), Control group ($p < 0.05$).The difference in mean value was reported as follows, experimental group > CON group

Group	Pre MSQ	Post MSQ	P value	Mean diff
Experimental Group	62.42 ±10.03	49.38 ±10.19	0.001	13.04
Control Group	64.80 ±8.82	52.76 ±9.27	0.001	12.04

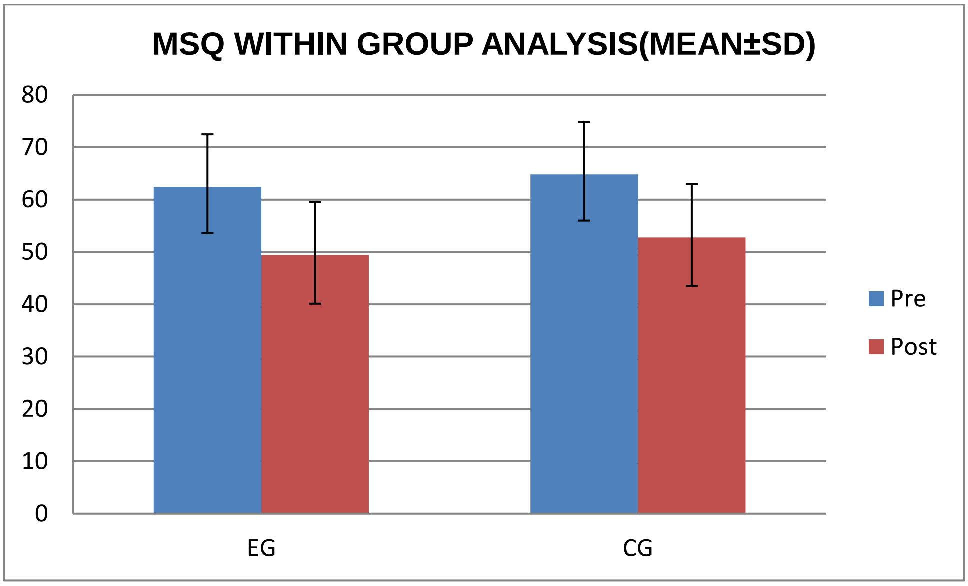


Fig- 2.6 MSQ MEASURE FOR WITHIN GROUP ANALYSIS

TABLE 1.6 BETWEEN GROUP ANALYSIS

Between-group analysis by independent t-test reported that there was a statistically significant difference ($p<0.05$) between the experimental and control group in the MSAQ scale. The experimental group showed better performance than the control group on the MSAQ scale.

Between-group analysis by the Mann-Whitney U test reported that there was a statistically significant difference ($p<0.05$) between the experimental and control group in the MISC scale. The experimental group showed better performance than the control group in the MISC scale

Between group analysis by independent t-test reported that there was no statistically significant difference ($p>0.05$) between the experimental and control group in MSQ.

Outcome	Post mean	P value
MSAQ	1.28	0.010
MISC	2.47	0.014
MSQ	1.00	0.75

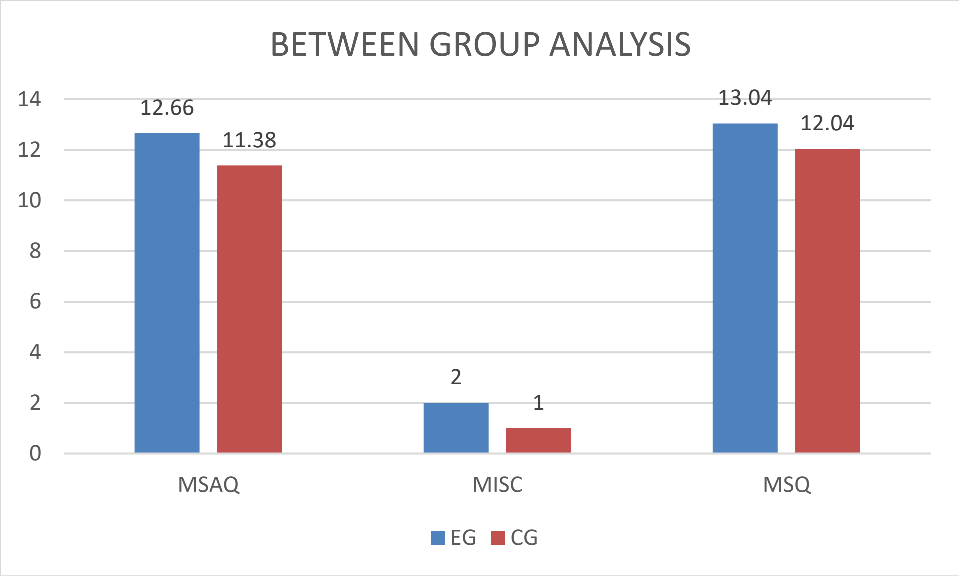


Fig- 2.7 BETWEEN GROUP ANALYSIS

RESULT

Statistical difference ($p<0.05$) was found within the experimental group (pre and post-intervention) for all the outcome measures i.e., MSAQ,MISC,MSQ as is expressed in Table 1.3,1.4,1.5 and figure 2.4,2.5 and 2.6

There was statistical difference found within the control group for all the outcome measures i.e., MSAQ,MISC,MSQ as is expressed in Table 1.3,1.4,1.5 and figure 2.4,2.5 and 2.6

Statistical significant difference was also found between the experimental and control group for the difference calculated between two of the outcome measures MSAQ and MISC as is expressed in Table 1.6 and figure 2.7 and No statistical difference was found between experimental and control group in MSQ as is expressed in Table 1.6 and figure 2.7

Hence the null hypothesis is rejected and alternate hypothesis is accepted which states that there is a significant effect of Vestibular telerehabilitation on reducing motion sickness in healthy individuals

DISCUSSION

This study aimed to investigate the effect of vestibular telerehabilitation on motion sickness in healthy individuals. Forty-two subjects with motion sickness were taken and twenty-one were given vestibular telerehabilitation for the experimental group and the rest twenty-one were given diaphragmatic breathing along with slow-paced breathing exercises for control group. Symptoms of motion sickness were assessed using **MSAQ, MISC,** and **MSQ**

We had hypothesized that Vestibular telerehabilitation would have significant effect on motion sickness in healthy individuals and findings indicate that VTR does help in reducing motion sickness in healthy individuals in two of the outcome measures that is MISC and MSAQ. So this study accepted alternative hypothesis.

The results of the study showed that both groups demonstrated significant improvement post-intervention for 6 weeks in MSAQ and Misery scale, suggesting vestibular telerehabilitation exercises were associated with a larger effect as Vestibular rehabilitation targets reducing the visual vestibular mismatch which could have reduced the effects of motion sickness.

In the present study, the Experimental group was prescribed Vestibular telerehabilitation exercises similar to the study by Vincent A vugt et al.[21] The vestibular telerehabilitation group showed better tolerance of motion sickness and reduction of motion sickness symptoms than the control group. This finding is consistent with the study by Vincent A van Vugt et al.[21] who had given internet-based vestibular rehabilitation in chronic vestibular syndrome and reported that after three and six months, participants in both the stand-alone internet-based VR group and the internet-based VR group with physiotherapy support (blended VR) experienced significantly fewer vestibular symptoms than participants in the usual care group. They also experienced less dizziness-related impairment, less anxiety, and more subjective improvement of vestibular symptoms. Vestibular telerehabilitation exercises greatly reduce gastrointestinal symptoms, and sopite symptoms because of habituation of the vestibular system with repetitive practice and auditory feedback. Initially, these movements provoke dizziness, but repetition for many weeks promotes neurological adaptation and compensation processes resulting in partial or complete resolution of symptoms. The exercises can also help patients to overcome fear and avoidance of activities that elicit disorientation, and regain skills[30] the habilitation approach states that the stimuli that provoke the person's symptoms can also be used to increase habilitation skills and helps the person to cope with the situation that disturbs the person and impair the quality of life[16]

The control group was trained with Diaphragmatic Breathing exercises which were given through tele-mode that greatly reduces the Central and sopite related symptoms and which shows increasing the activation of the parasympathetic nervous nervous system. A study by Matthew Edward Brannon Russell et al.[18] shows that diminished parasympathetic nervous system activity can precipitate motion sickness symptoms; they also suggest that strategies designed to enhance parasympathetic nervous system activity may be useful in reducing motion sickness symptoms. Matthew Edward Brannon Russell et al. [18] revealed that the combined effect of diaphragmatic breathing mechanics and slowed respirations per minute indicates that these may be effective strategies for significantly increasing parasympathetic tone and protecting against motion sickness during exposure to motion sickness-inducing stimuli

Between-group analysis in **MSAQ** and **MISC** scale revealed that there is a significant difference between the experimental group and the control group where the experimental group showed better tolerance of motion sickness and less occurrence of vomiting, nauseating feelings, and other motion sickness symptoms than the control group because the exercise which was given in Vestibular rehabilitation consists of nodding and shaking the head. Repeated practice of these movements promotes adaptation and the gradual reduction of movement-provoked symptoms like dizziness, nausea, vomiting. Importantly, the exercises also lead to psychological habituation to the symptoms and reductions in avoidance behaviours. [30] The positive effects of Vestibular rehabilitation on reducing symptoms of motion sickness seen in this study are in line with the results of previous VR randomized controlled trials in general practice in older individuals.[30]

Motion Sensitivity Quotient is designed to measure motion provoked dizziness. In MSQ The experimental group that is VTR group did not show a better beneficial effect than the breathing exercise group could be because Dizziness in motion sickness can be exacerbated by inadequate oxygenation, which can lead to altered blood flow to the brain. Diaphragmatic breathing increases the efficiency of oxygen exchange, enhancing blood oxygen levels and optimizing brain function. Moreover, by promoting relaxation and sensory integration, diaphragmatic breathing can help the brain process conflicting sensory inputs more effectively, potentially reducing dizziness. A study by Rahimi MD et al.[34] Diaphragmatic breathing can improve brain function function via corticalsubcortical control, which is related to shared breathing centers and Dizziness-related networks such as the brainstem and medullary centers.

In VTR group controlled head shaking and nodding manuever exploit the vestibular system's ability to adapt and recalibrate, these techniques draw from the principles of sensory adaptation and habituation. A study by Adam W. A. Geraghty et al. [30] stated that Internet-based vestibular rehabilitation is effective in reducing dizziness symptoms and dizziness-related disability in primary care patient. By engaging in rhythmic and controlled movements, individuals deliberately expose their vestibular systems to motion sensations. This exposure prompts the brain to adapt and reduce its sensitivity to the specific type of motion that triggers motion sickness. Through repetition and controlled intensity, the vestibular system becomes less prone to generating symptoms of dizziness upon subsequent exposure to similar motion stimuli. So even though VTR group helps in reducing dizziness related symptoms control group also helped in reducing dizziness related symptoms so in motion sensitivity quotient there was no statistical significant difference

LIMITATIONS

However, this study has certain limitations:

1. Sample size was less

2. Follow-up was not taken

3. Only qualitative measurements were taken

4. Female Participants were more than male Participants

5. Short period of intervention

6. Technical limitation- Reliable internet connectivity and suitable devices are necessary for effective telerehabilitation, which may limit accessibility for some individuals

7. Individual Variability: Not all individuals may respond equally to telerehabilitation,

FUTURE RECOMMENDATION

1. This study can be done on larger sample size
2. Post-intervention follow-up should be included.
3. Future studies should focus more of quantitative measure outcome
4. The study can be done in the other age group
5. Further research is needed to determine the long-term sustainability of motion sickness symptom reduction achieved through vestibular telerehabilitation

CONCLUSION

According to our present study Vestibular telerehabilitation presents a promising avenue for reducing motion sickness symptoms, particularly dizziness. By targeting the underlying vestibular system and leveraging technology to provide convenient interventions, this approach offers a novel way to improve the well-being of individuals prone to motion sickness. Continued research and technological advancements will contribute to optimizing the effectiveness and accessibility of vestibular telerehabilitation for motion sickness management.

CLINICAL IMPLICATIONS

Telerehabilitation-based vestibular training could enable clinicians to provide broad and rapid access to low-cost while maintaining treatment efficacy for their patients experiencing motion sickness. The mean age of our sample were younger and middle aged adults suggesting that provision via digital technology may not be a barrier to effectiveness in adults.

Telerehabilitation eliminates geographical barriers, enabling individuals to access therapeutic interventions regardless of their location, Telerehabilitation platforms can be tailored to individual needs, allowing for personalized exercise regimens and progress tracking and Individuals can engage in vestibular exercises at their preferred time and place, enhancing compliance and engagement.

STRENGTH

- A high level of adherence was reported by both the experimental group and the control group. This was an important finding because adherence has been found to affect outcomes. Yardley and Kirby[35] measured adherence and found that greater adherence resulted in a greater improvement in symptoms in a home-based vestibular rehabilitation program.
- Telerehabilitation mode is a rapid access and cost-effective method of treatment for the subjects who live in remote areas too and for those who cannot come to the clinical setting regularly.

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ANNEXURES.1

CONSENT FORM

CONSENT FORM

Title of the study –

EFFECT OF VESTIBULAR TELEREHABILITATION ON MOTION SICKNESS IN HEALTHY INDIVIDUALS - A RANDOMIZED CONTROLLED TRIAL

I have been informed by Ms. Priyanka Nahak; pursuing MPT (Neuro) conducting the above-mentioned study under the guidance of Dr. Sonali Soumyashree Assistant Professor Department of Neuro Physiotherapy ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE (ABSMARI), BHUBANESWAR.

I have no objection and will be a part of that group. I also understand that the study does not have any negative implication on my health. I understand that the information produced by the study will become a part of the institute's record and will be utilized, as per confidentiality regulations of the institute. I am also aware that the data might be used for medical literature and teaching purposes, but all my personal details will be kept confidential.

I am well informed to ask as many questions as I can to Ms. Priyanka Nahak either during the study or later.

I understand that my assent is voluntary and I reserve the right to withdraw or discontinue the participation from the study at any point of time during the study.

I have explained to MR/MISS/MRS   the purpose of the research, the procedure required in the language he/she could understand to the best of my ability.

(Investigator)   (Date)

ANNEXURES- 2

DATA COLLECTION FORM

DATA COLLECTION FORM

SUBJECT NUMBER - DATE- / /

AGE/GENDER-

HEIGHT

WEIGHT

ADDRESS-

CONTACT NO.-

Name of the test	Pre test score	Post test score
MSAQ		
MISC		
MSQ		

ANNEXURES-3

MASTER CHART

1	Group	Gender	age	BMI	Height(CM	Weight	Pre MSAQ	Post MSAQ	Pre MISC	Post MIS(	Pre MSQ	Post MSQ
2	1	1	27	25.7	154	61	83	74	8	5	65	53
3	1	1	26	32	142	65	75	61	10	8	56	40
4	1	1	27	20	160	53	66	51	7	6	48	35
5	1	2	28	29.4	167	82	49	38	6	4	42	31
6	1	2	30	25.3	180	82	87	84	8	7	69	54
7	1	2	28	24	185	85	78	66	7	5	67	53
8	1	2	28	25.6	182	85	76	64	10	8	63	51
9	1	1	27	21	152	50	94	83	10	7	61	45
10	1	1	34	26.8	152	62	99	88	8	7	71	61
11	1	1	22	19	165	52	78	65	8	7	62	47
12	1	1	22	19	163	52	68	56	6	5	43	30
13	1	1	21	17.2	167	48	71	59	8	6	62	51
14	1	1	23	31	152	73	69	54	6	3	58	47
15	1	1	37	33.3	157	82	76	63	6	4	66	52
16	1	1	27	26.5	160	68	87	72	10	8	70	60
17	1	1	27	31.6	154	75	88	75	9	6	73	58
18	1	2	36	21.9	167	61	69	54	5	3	49	37
19	1	2	28	23.7	172	70	78	64	8	5	69	55
20	1	2	29	25.3	165	69	73	62	8	6	64	48
21	1	1	37	28.1	152	65	82	71	9	8	76	62
22	1	1	32	23.8	165	65	84	70	8	5	77	67
23	2	2	33	25.8	167	72	89	77	9	8	81	70
24	2	2	38	25.4	172	75	77	69	8	7	73	61
25	2	1	31	29.3	162	77	65	53	6	5	61	50
26	2	1	27	30.8	154	73	84	73	9	7	79	68
27	2	2	39	23.1	165	63	72	61	8	7	58	45
28	2	1	26	29.4	152	68	68	56	6	5	61	49
29	2	1	32	23.8	165	65	76	62	8	6	66	56
30	2	2	32	26.3	172	77	79	70	7	6	71	59
31	2	1	38	26	152	60	67	55	6	4	54	42
32	2	2	31	22.5	172	65	61	50	5	3	49	36
33	2	1	39	30	161	78	71	61	7	6	67	53
34	2	2	38	26.5	180	86	77	65	8	7	73	61
35	2	2	34	24.6	160	63	70	59	8	6	65	54
36	2	2	21	36	170	36	75	62	9	8	67	52
37	2	1	36	29.4	152	68	78	67	7	5	74	61
38	2	1	35	28	157	68	86	76	10	9	68	57
39	2	2	28	21	175	67	66	55	6	4	62	52
40	2	1	36	29	153	69	73	60	7	5	65	53
41	2	1	27	29.2	156	71	57	45	5	4	47	33
42	2	2	30	23.8	170	69	70	57	7	5	61	47
43	2	2	33	23.38	167	65	78	67	8	7	59	49

ANNEXURES-4

ETHICAL COMMITTEE CLEARANCE CERTIFICATE

ABHINAV BINDRA
Sports Medicine & Research Institute
A Unit of the Abhinav Bindra Foundation Trust
Recognised by DMET, Health & FW Dept., Govt. of Odisha, Affiliated to Utkal University
Recognised by Odisha State Council for Occupational Therapy and Physiotherapy

Head Office:
Plot No.-107, Sector-82
JLPL Industrial Area,
Sahibzada Ajit Singh
Nagar, Punjab - 140306
+91 99156 31755
principal@absmari.com

Reference No. – ABSMARI/IRB/06/2023
Date: 22nd June 2023

INSTITUTIONAL REVIEW BOARD

To

Ms Priyanka Nahak,

Post Graduate student, Department of Physiotherapy,

Abhinav Bindra Sports Medicine and Research Institute (ABSMARI).

This is to certify that your proposal for the study titled **"Effectiveness of Vestibular Telerehabilitation in Motion Sickness in Healthy Adults – RCT"** has been taken for discussion in the meeting held on 20th May 2023. Following the meeting, the committee approves the proposal and it has no objection on the study being carried out.

You are advised to familiarize yourself with the ICMR guidelines on biomedical research in human subjects and also adhere to the principles of Good Clinical Practice. You are hereby directed to submit the final report to the committee, on completion of the study. Any case of adverse reactions should be informed to this ethics committee and action will be taken thereafter.

Any such adverse reactions during the course of the study are the sole responsibility of the Principal Investigator and there is no onus on the Ethical Committee members resulting thereof.

We wish you all the best for your study.

22.6.23
Member Secretary

ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE
ABSMARI
BHUBANESWAR

22/6/23
Chair Person