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Impact of Vestibulo-Ocular Reflex (VOR) Exercise on Visual Fatigue among College Students Wearing Spectacles: A Pilot Study

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Abstract: ***Visual fatigue is a common condition among individuals who engage in prolonged near-work activities such as reading, studying, or screen time.In recent years, the increasing reliance on digital devices for academic, social, and entertainment purposes has led to a rise in visual fatigue, particularly among college students. This pilot study evaluated the effect of vestibulo-ocular reflex (VOR) exercises on reducing visual fatigue in college students wearing spectacles. Subjective visual fatigue was assessed using the Asthenopia Questionnaire before and after a 6-week intervention. Participants aged 18–28 years were included, and pre- and post-test scores were analyzed using a paired t-test. The mean questionnaire score decreased from 21.40 ± 9.06 at pre-test to 12.08 ± 4.59 at post-test, showing a statistically significant improvement (t = 4.58). The findings suggest that VOR exercises are effective in significantly reducing visual fatigue among spectacle-using college students.***

Keywords: Visual fatigue, spectacle user, Asthenopia questionnaire, vestibule ocular reflex

1. Introduction

Visual fatigue is a common condition among individuals who engage in prolonged near-work activities such as reading, studying, or screen time. In recent years, the increasing reliance on digital devices for academic, social, and entertainment purposes has led to a rise in visual fatigue, particularly among college students. The vestibulo-ocular reflex (VOR) is an involuntary reflex that stabilizes the visual field and retinal image during the motion of the head by producing eye movements in a counter direction [1]. VOR uses information from the vestibular labyrinth of the inner ear to produce eye movements that stabilize the gaze during head movements.[1]

When an individual moves his/her head, the eyes rotate effortlessly so that the world does not appear to move in the opposite direction. VOR adapts so that eye movements have the appropriate magnitude. Climbing nerve fibers provide signals about the slippage of the image on the retina.[2] The rotational VOR (rVOR) generates a slow phase eye movement that compensates for horizontal (yaw), vertical (pitch), or torsion (roll) head rotations.[2] The normal rVOR is compensatory in direction and speed during yaw and pitch head rotations. The effectiveness of the rVOR is usually characterized by its gain, which is defined as the ratio of the velocity of the nystagmus slow phase over the velocity of head rotation.

This pilot study seeks to explore the impact of VOR exercises on visual fatigue in college students who wear spectacles. By evaluating changes in visual fatigue before and after a period of VOR training, the study aims to assess whether these exercises can effective intervention to reduce eye strain and enhance visual comfort among this population.

2. Aim of the Study

The aim of the study is to find out impact of vestibulo-ocular reflex (VOR) exercise on visual fatigue among college students wearing spectacles. Objective of this study to evaluate the effect of VOR exercises on reducing visual fatigue in college students wearing spectacles.

3. Methodology

The study was Pilot study design.15 subjects in the age group between 18 to 28 years were selected based on the inclusion criteria. Both male and female included in this study. The pre-test was taken by 30 subjects using asthenopia questionnaire. After 6 weeks of the treatment, a post-test was taken for the subjects.

4. Procedure

4.1 Eye Relaxation Exercise

Patient in sitting with ask them to relax eye closed with palm, eye closed with finger and cross hand closing

4.2 Horizontal VOR Exercise

Patient in sitting. Ask them to focus on a target in front of you (such as a letter on the wall). Move your head side-to-side while keeping your eyes fixed on the target.
Repeat for 1-2 minutes

4.3 Vertical VOR Exercise

Patient in sitting. Like the horizontal exercise but this time, move your head up and down while focusing on the same target
Repeat for 1-2 minutes

4.4 Walking Vor Exercise

Patient in walking. Therapist encourage them to walk slowly in a straight line while moving your head side-to-side or up and down, keeping your eyes on a single point ahead of you.

Repeat the exercise 2-3 times a day for 6 weeks

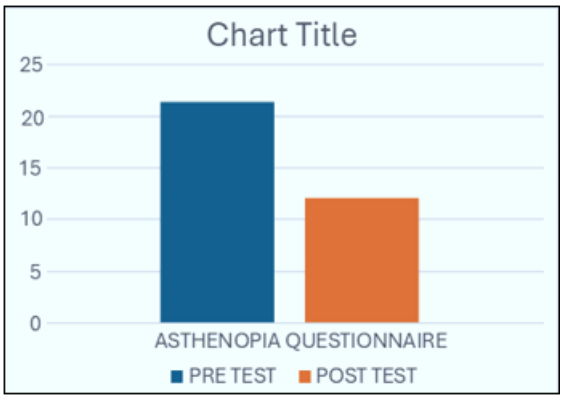
4.5 Eye Relaxation Exercise

4.6 Horizontal VOR Exercise

4.7 Walking VOR Exercise

5. Statistical Analysis

Asthenopia Questionnaire



6. Result

In this pilot study paired t test was used to find out the mean and standard deviation of pre-test and post-test value of Asthenopia Questionnaire. In the statistical analysis, the calculated mean value for the pre-test and post-test for Questionnaire is **21.40** and **12.08** and the calculated standard deviation value of the pre and post-test is **±9.06** and **±4.59**. Hence, the statistical data analysis shows that the paired t-test value of asthenopia Questionnaire **t-value = 4.58** is highly significant effect on VOR exercise in reducing visual fatigue

7. Discussion

This study was to investigate the impact on vestibule ocular reflex exercise on visual fatigue among college students wearing spectacles. Overall, 15 subjects in the age group between 18 to 28 years were selected based on the inclusion criteria. Both male and female basketball players with hamstring tightness have been included in this study. The pre-test was taken by 30 subjects using asthenopia questionnaire. After 6 weeks of the treatment, a post-test was taken for the subjects.The findings suggest that regular performance of VOR exercises may lead to a reduction in visual fatigue symptoms in this population. These results highlight the potential role of vestibular-based oculomotor interventions in managing visual discomfort associated with prolonged visual tasks

Gaikwad et al. demonstrated that gaze stability exercises enhanced postural stability in individuals with chronic motion sensitivity by gradually engaging the vestibulo-ocular reflex through adaptation exercises. This suggests that the VOR may be impaired in individuals with chronic motion sensitivity. It is likely that the addition of VOR training induce positive result among spectacle users. The findings of this study are consistent with earlier research indicating that oculomotor and vestibular exercises can positively influence visual comfort and reduce asthenopic symptoms[10]. Although VOR exercises are commonly used in vestibular rehabilitation, their application in managing visual fatigue among non-pathological populations, such as college students, remains underexplored. This pilot study contributes preliminary evidence supporting their broader use in preventive and rehabilitative visual health programs. These results highlight the potential role of vestibular-based oculomotor interventions in managing visual discomfort associated with prolonged visual tasks

8. Conclusion

This study concluded that there is a significant improvement in visual fatigue after 6 weeks of vestibulo ocular reflex exercise among college students wearing spectacles. Hence, null hypothesis are rejected.

9. Limitations

Small sample size. Short study duration may not capture long term effects and Self-reported data on adherence to the intervention may introduce biases.

10. Recommendations for Future Research

Future studies should recruit participants from various age groups. Likely to use of larger sample sizes to increase the statistical power and ability to detect the existence of treatment effects while concomitantly reducing the chances of making a Type II error.

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