Original Article

Comparison of Effects of the Five Points Hands Free Program Versus Standard Eye Exercises in Office Workers with Computer Vision Syndrome in Trang Hospital

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ABSTRACT

Objectives: To compare the effects of the five-point hands free (FPHF) exercise program and standard eye exercises on computer vision syndrome (CVS) and vestibulo-ocular symptoms among Trang Hospital staff.

Study design: A prospective, comparative, cluster-randomized study

Setting: Trang Hospital, Trang, Thailand

Subjects: Sixty-two office workers with CVS symptoms

Methods: Participants were divided into a standard exercise group (n=31) and a FPHF group (n=31). CVS symptoms were assessed using the CVS questionnaire. Vestibular ocular motor function was evaluated using the Vestibular/Ocular Motor Screening (VOMS) tool before and after a 3-week intervention.

Results: After three weeks, both the FPHF and the standard group improved CVS and VOMS scores. The FPHF group had a reduction in almost all symptoms, similar to the standard group. The FPHF group significantly reduced headaches, dizziness, and fogginess during VOMS ($p < 0.05$). However, between-group differences in CVS and VOMS cumulative scores were not statistically significant.

Conclusions: The FPHF program demonstrated potential benefits in reducing CVS and vestibulo-ocular symptoms, suggesting that it may be a viable alternative intervention for managing CVS. However, further research is needed to establish its long-term effectiveness compared to standard exercises.

Keywords: dizziness, occupational health, exercise therapy, computers

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Introduction

In today's digital era, electronic devices such as computers, tablets, and smartphones have become essential for work and communication.[1] Healthcare personnel rely heavily on computers for continuous patient data recording and service provision.[2] Digital technology is crucial in the modern healthcare system, enabling provision of efficient, high-quality services and increasing access to care via digital platforms.[3] Despite the benefits of digital technology in healthcare, its extensive use comes with potential drawbacks. Specifically, these technologies may adversely affect the users' health, e.g., computer vision syndrome (CVS), a condition resulting from prolonged digital device use.[4]

CVS is especially prevalent among healthcare workers who regularly use these tools.[5,6] It is characterized by a complex of eye and vision-related symptoms, including eyestrain, headaches, blurred vision, dry eyes, and neck and shoulder pain.[7] These symptoms result from individual visual problems, poor workplace conditions, and improper work habits.[8] Previous studies have identified increased risks to long-term computer users,[9] which may lead to reduced work productivity, increased error rates, and poor job satisfaction.[10]

While the prevalence of CVS is well-documented, its complex pathophysiology involves multiple mechanisms. Prolonged close work and sustained inappropriate accommodation can lead to ciliary muscle fatigue and reduced accommodative amplitude.[11] Infrequent blinking and increased tear evaporation during computer use disrupt the tear film, causing ocular surface dryness and irritation.[12] The use of electronic screens also exposes the eyes to high-energy visible light, which may cause retinal damage and increase the risk of age-related macular degeneration.[13]

Additionally, CVS can cause dizziness. While current studies have not established a direct link between CVS and neuro-ophthalmology, there is a recognized association between ocular and vestibular dysfunctions.[14] Symptoms of CVS, including vertigo/dizziness, can be exacerbated by visually induced aggravation, known as visual vertigo (VV).[15,16] This suggests a potential overlap of these symptoms. Given the multifaceted nature of CVS, comprehensive rehabilitation approaches remain limited.[17] Prevention methods include

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addressing factors such as lighting, screen settings, posture, using eye drops, taking visual breaks, and performing eye exercises.[4] Standard eye exercises, such as eye-rolling, focusing, and palming, aim to reduce eye strain by relaxing eye muscles and improving blood circulation.[18] While effective for alleviating some CVS symptoms, these exercises primarily focus on ocular health and may not address the broader neuro-ophthalmic and vestibular aspects of CVS.

Trang Hospital established a Vertigo Clinic in 2007 to provide vestibular rehabilitation for patients with dizziness. Experienced physical therapists assess visual stability and provide eye exercises to reduce visual disturbances after canalith repositioning procedures (CRP).[19,20] The clinic has also developed a Five Points Hand Free (FPHF) program for patients with benign paroxysmal positional vertigo (BPPV) post-CRP, which has shown promising results.[21] The FPHF program, which is based on vestibular rehabilitation, targets both visual and vestibular systems with coordinated head and eye movements, improving gaze stability and balance. The program can be implemented without specialized equipment.

Recognizing the potential overlap between CVS and vestibular symptoms, this study aimed to explore a new avenue for managing CVS. The researcher hypothesized that CVS symptoms may share similarities with post-CRP symptoms in BPPV patients. The FPHF program offers a new approach to managing CVS, especially with increased digital technology use at work. Its advantages over standard eye exercises include a comprehensive approach, improved gaze stability, enhanced vestibular-ocular reflex, ease of implementation, and potential long-term benefits by targeting vestibular function more effectively than eye exercises alone.

This study aimed to compare the effects of the FPHF program and standard eye exercises on CVS symptoms and vestibulo-ocular symptoms among Trang Hospital staff. The findings may guide the development of eye health interventions and strategies for effectively working with digital technologies in the future.

Methods

The participants were comprised of staff from various departments at Trang Hospital. Participation was voluntary and recruitment was conducted through announcements and posters. Eligible participants were assigned to groups using the cluster random sampling method. Based on the 2020 research by Gupta et al. on ocular exercises for CVS, the initial sample size was 16 participants per group. To account for potential dropouts, an additional 20% was added, resulting in a target of 40 participants. However, all 62 eligible volunteers were included in the study to mitigate dropout risks and enhance statistical power. This study was approved by the Trang Hospital Human Research Ethics Committee (ID006/02-2566)

The inclusion criteria were as follows: age between 20 and 60 years, working with computers for at least 2 hours per day and having at least one symptom of CVS. The exclusion criteria included a history of eye injuries or surgery, severe dry eyes or other ocular surface disorders, binocular vision disorders, and neurological or vestibular disorders. The data collection was conducted from February to March 2024.

Intervention included standard eye exercises[18] and FPHF exercises[21] as follows:

Standard eye exercises:

1. Distant gazing: Look at a distant object for 10-15 seconds, then focus on a near object for 10-15 seconds. Repeat 10 times.
2. Eye rolling with eyes closed: Slowly roll your eyes in a circular motion clockwise and counterclockwise, performing five rotations in each direction.
3. Finger focusing at eye level: Hold a finger at arm's length, focus on it with both eyes for 10-15 seconds, then focus on a distant object for 10-15 seconds. Repeat 10 times.

Participants were instructed to perform these exercises 2 times daily, each lasting approximately 5-7 minutes.

Five Points Hand Free Exercises:

1. Using an exercise chart with five numbered points arranged in a cross pattern: a) Face forward and gaze at each of the different numbered points alternately 20 times per set. b) Lock gaze on number 1 (center point), then move the head left-right and up-down 20 times while maintaining focus.
2. Perform 3 sets of these exercises, with a 30-second rest between sets.
3. Total exercise duration: approximately 10 minutes per session, to be performed twice daily.

Participants in the study were single-blinded and received interventions administered by experienced physical therapists. They were divided into two groups: standard exercise (n=31) and FPHF (n=31). Exercises were designed and supervised by two physical therapists with over 15 years of experience and were conducted daily from Monday to Friday. Participants were instructed to practice at home daily for 3 weeks.[18] Adherence was monitored through weekly interviews, daily logs, and reverse demonstrations to ensure compliance. Interviews included questions on exercise frequency, duration, and any modifications made.

Outcome measurements

Participants completed a general information questionnaire, the CVS questionnaire[22] and underwent the Vestibular Ocular Motor Screening (VOMS)[23] assessment before and after the 3-week intervention. The CVS questionnaire evaluates the frequency and intensity of 16 symptoms, including ocular (e.g., eyestrain, eye pain, dry eyes, tearing), visual (e.g., blurred vision, double vision), and musculoskeletal (neck, shoulder, or back pain) symptoms, on a scale of 0-3. The total score ranges from 0 to 48, with higher scores indicating greater severity.

The VOMS is a validated screening tool for identifying vestibular and ocular motor impairments. It consists of brief assessments of smooth pursuits, saccades, near point of convergence (NPC), horizontal and vertical vestibulo-ocular reflex (VOR), and visual motion sensitivity (VMS). Participants rate their headache, dizziness, nausea, and fogginess on a scale of 0-10 after each assessment. Higher scores indicate greater symptom provocation. Moreover, VOMS is an assessment tool commonly used in vestibular rehabilitation clinics, providing physical therapists with a reliable method for evaluating outcomes.

The outcome assessors, experienced physical therapists, were blinded to the participants' group allocations and were not involved in the intervention administration. To ensure the reliability of variable assessments, the assessors underwent specific training. Participants were instructed not to disclose their group assignment or discuss their exercises. The trained assessors conducted the VOMS and consistently administered the CVS questionnaire across all evaluations to maintain uniformity in assessment.

Data analysis

Participants' baseline data were analyzed using descriptive statistics. Proportions were compared using the Chi-square test. A nonparametric analysis of CVS symptoms and VOMS scores was performed. The Friedman test was conducted to examine differences across multiple conditions, and the Bonferroni correction was applied to adjust for type I errors. If significant results were found, post-hoc analyses were performed using the Wilcoxon Signed-Rank Test for within-group comparisons or the Mann-Whitney U Test for between-group comparisons. Statistical significance was set at $p < 0.05$ in all cases.

Results

Out of 139 registered participants, only 62 met the inclusion criteria and provided informed consent. Table 1 shows the baseline demographic characteristics of the 62 participants, divided into the standard exercise group (n=31) and the FPHF exercise group (n=31). There were no statistically significant between-group differences in any baseline characteristics ($p > 0.05$), indicating effective randomization and a reduced likelihood of confounding effects on treatment outcomes.

Table 2 presents a statistical analysis comparing CVS symptom severity scores between the standard and FPHF exercise groups. At pre-intervention, there were no significant differences in CVS scores between groups ($p > 0.05$). Post-intervention, both groups had significantly reduced total CVS scores ($p < 0.05$). The FPHF group showed significant reductions in headache, eye pain, photophobia, blurred vision, and double vision ($p < 0.05$), while the standard group had significant decreases in headache, eye pain, burning eyes, photophobia, and blurred vision ($p < 0.05$). However, as shown in Table 3, the cumulative CVS scores showed statistically significant differences only within groups when analyzed using the Friedman test with Bonferroni correction.

This study evaluated the impact of eye movements on symptom severity using the VOMS tool (Table 4). Both groups exhibited low baseline severity for headache, dizziness, nausea, and fogginess (median score = 0) and showed no significant post-test changes in almost all domains ($p > 0.05$), except NPC distances. However, the cumulative VOMS scores demonstrated improvement in both groups, with significant improvements observed in the standard group, specifically in horizontal saccades and convergence (Table 5). Furthermore, NPC was analyzed but our study found no improvement after treatment in either group.

Discussion

This study aimed to compare the effects of the FPHF program and standard eye exercises on CVS symptoms and vestibulo-ocular symptoms among Trang Hospital staff. Based on total CVS and VOMS scores, the FPHF group did not differ significantly from the standard group in overall outcomes. However, both interventions demonstrated effectiveness in reducing CVS symptoms and improving vestibulo-ocular function.

Although both interventions had similar effects, their mechanisms of action differ. Standard exercises, based on the concept of visual fatigue from prolonged screen focusing and frequent lens adjustment, aim to relieve eye muscle tension and promote ocular blood flow through near-far focusing[24] while the FPHF program is based on vestibular rehabilitation principles, focusing on improving gaze stability and visual-vestibular integration through coordinated head and eye movements.

The FPHF program is based on vestibular rehabilitation principles, emphasizing stimulation and balance of the inner ear vestibular system, which works closely with the visual system.[25] The vestibular system maintains eye stability and prevents visual images from 'slipping' on the retina's surface as the head position changes. Vestibular dysfunction can manifest as dizziness, motion sensitivity, and impaired gaze stability, which may exacerbate CVS symptoms.[26] The FPHF program also includes coordinating visual input, vestibular input, and proprioception through simultaneous head and eye movements in various planes to stimulate the vestibulo-ocular reflex (VOR). This mechanism promotes gaze stabilization, reduces visual motion sensitivity, and improves postural control.[20]

The effectiveness of vestibular rehabilitation in improving dizziness and balance function has been well-established in the literature. Cochrane Review found that vestibular rehabilitation significantly improved dizziness symptoms and balance function in patients with various vestibular disorders.[20] These findings support the potential benefits of the FPHF program, which incorporates vestibular rehabilitation principles, in managing CVS symptoms. The VOR is a crucial reflex that stabilizes vision during head movements by generating compensatory eye movements in the opposite direction.[27,35]

Table 1. Baseline demographic characteristics of the participants (n=62)

Characteristics	Standard exercise group (n=31) n (%)	FPHF exercise group (n=31) n (%)	Total	*p*-value
Gender				0.86[a]
Male	5 (16.10)	1 (3.20)	6	
Female	26 (83.90)	30 (96.80)	56	
Age				0.86[a]
20-30 years	1 (3.20)	2 (6.50)	3	
31-40 years	8 (25.80)	7 (22.60)	15	
41-50 years	14 (45.20)	12 (38.70)	26	
51-60 years	8 (25.80)	10 (32.30)	18	
Education				0.25[a]
Below diploma	2 (6.50)	1 (3.20)	3	
Diploma	2 (6.50)	4 (12.90)	6	
Bachelor's	24 (77.40)	26 (83.90)	50	
Above bachelor's	3 (9.70)	0 (0.00)	3	
Dominant hand				0.72[a]
Left	4 (12.90)	5 (16.10)	9	
Right	27 (87.10)	26 (83.90)	53	
Vision problems				0.49[a]
No problem	12 (38.70)	12 (38.70)	24	
Myopia	7 (22.60)	7 (22.60)	14	
Hyperopia	9 (29.00)	12 (38.70)	21	
Astigmatism	2 (6.50)	0 (0.00)	2	
Color blindness	1 (3.20)	0 (0.00)	1	
Wearing glasses				0.73[b]
No	17 (54.80)	17 (54.80)	34	
Wearing contact lenses				1.00[b]
Yes	29 (93.50)	29 (93.50)	58	
Daily computer use				1.00[b]
≤ 4 hours/day	4 (12.90)	1 (3.20)	5	
> 4 hours/day	27 (87.10)	30 (96.80)	57	
Musculoskeletal disorders				0.41[a]
No	20 (64.50)	23 (74.20)	43	
Daily sleep duration				0.37[a]
< 4 hours/day	1 (3.20)	0 (0.00)	1	
46 hours/day	6 (19.40)	7 (22.60)	13	
68 hours/day	24 (77.40)	22 (71.00)	46	
> 8 hours/day	0 (0.00)	2 (6.00)	2	
Exercise frequency				0.48[a]
None	3 (9.70)	6 (19.40)	9	
12 times/week	13 (41.90)	15 (48.40)	28	
34 times/week	12 (38.70)	7 (22.60)	19	
> 4 times/week	3 (9.70)	3 (9.70)	6	
Regular medication use				0.78[b]
No	23 (74.20)	21 (67.70)	44	
Underlying diseases				0.80[b]
No	20 (64.50)	18 (58.00)	38	
Eye diseases				1.00[b]
No	30 (96.80)	30 (96.80)	60	
Occupational health training				0.41[b]
No	11 (35.50)	20 (64.50)	31	
Occupational health assessment				0.11[b]
No	16 (51.60)	23 (74.20)	39	

[a], Chi-Square; [b], Fisher's exact test; [*] *p*-value < 0.05

Impairments in VOR gain or phase can cause retinal slip and oscillopsia, leading to visual disturbances and dizziness.[28] The FPHF exercises aim to enhance VOR adaptation and improve visual-vestibular interaction, which may be disrupted in individuals with CVS.[29] Furthermore, the FPHF program incorporates smooth pursuit and saccadic eye movements, which are essential for tracking moving objects and quickly shifting gaze between targets, respectively.[30] Deficits in these eye movements can impair reading ability, visual search, and attention, contributing to visual fatigue and discomfort.[31] The

Table 2. Comparison of computer vision syndrome (CVS) symptom severity scores between the standard and the five points hand free (FPHF) exercise groups

CVS symptoms	Standard exercise group (n=31)			FPHF exercise group (n=31)		
	Pre Median (IQR)	Post Median (IQR)	Wilcoxon Signed Ranks Test (within group)	Pre Median (IQR)	Post Median (IQR)	Wilcoxon Signed Ranks Test (within group)
1. Headache	1 (0.00-1.00)	0 (0.00-1.00)	$p = 0.00^*$	1 (1.00-1.00)	1 (0.00-1.00)	$p = 0.00^*$
2. Eye pain	1 (1.00-1.00)	0 (0.00-1.00)	$p = 0.00^*$	1 (1.00-2.00)	1 (0.00-1.00)	$p = 0.00^*$
3. Burning eyes	1 (1.00-2.00)	1 (0.00-1.00)	$p = 0.01^*$	1 (1.00-2.00)	1 (0.00-1.00)	$p = 0.14$
4. Eye irritation	1 (0.00-1.00)	0 (0.00-1.00)	$p = 0.10$	1 (0.00-1.00)	1 (0.00-1.00)	$p = 0.10$
5. Dry eyes	1 (0.00-1.00)	0 (0.00-1.00)	$p = 0.32$	1 (0.00-2.00)	1 (0.00-1.00)	$p = 0.40$
6. Tearing	1 (0.00-1.00)	0 (0.00-1.00)	$p = 0.10$	1 (0.00-1.00)	0 (0.00-1.00)	$p = 0.09$
7. Photophobia	1 (0.00-1.00)	0 (0.00-1.00)	$p = 0.00^*$	1 (0.00-1.00)	0 (0.00-1.00)	$p = 0.00^*$
8. Blurred vision	1 (0.00-1.00)	0 (0.00-1.00)	$p = 0.01^*$	1 (0.00-2.00)	1 (0.00-1.00)	$p = 0.00^*$
9. Poor visual acuity	1 (0.00-1.00)	0 (0.00-1.00)	$p = 0.01^*$	1 (1.00-2.00)	1 (0.00-1.00)	$p = 0.02^*$
10. Double vision	0 (0.00-1.00)	0 (0.00-0.00)	$p = 0.10$	1 (0.00-1.00)	0 (0.00-1.00)	$p = 0.02^*$
Total score	9 (4.00-11.00)	3 (1.00-10.00)	$p = 0.00^*$	10 (7.00-13.00)	6 (3.00-9.00)	$p = 0.00^*$

$^*p$-value < 0.05; IQR, inter-quartile range

Table 3. Comparison of cumulative score of the computer vision syndrome (CVS) symptoms between the standard and the five points hand free (FPHF) exercise groups

CVS symptom Cumulative score (0-40) Condition	Median (IQR 1-3)	Mean rank	Friedman test χ^2	*p*-value Post hoc with Bonferroni		
				Asymp. Sig.	Within group	Between group
Pre standard exercise	9.00 (4.00-11.00)	2.77	19.77	< 0.01	0.02*	NS
Post standard exercise	3.00 (1.00-10.00)	1.82				
Pre FPHF exercise	10.00 (7.00-13.00)	3.13			0.05	
Post FPHF exercise	6.00 (3.00-9.00)	2.27				

$^*p$-value < 0.05; CVS; IQR, inter-quartile range; Asmp. Sig., Asymptotic Significance (*p*-value)

FPHF exercises provide a structured approach to train these eye movements and improve visual efficiency.

While traditional eye exercises have primarily focused on alleviating eye muscle strain[4,32], CVS encompasses a range of symptoms both related and unrelated to eye muscle function. These symptoms include headaches, blurred vision, neck pain, fatigue, dry eyes, and dizziness, suggesting that a more comprehensive approach is necessary to address the full spectrum of CVS manifestations. Studies have found that these exercises help alleviate eye strain and CVS to some extent but are limited to the eyes only.[24] These techniques have not been previously studied for their neurological effects associated with CVS.

The lack of significant between-group differences in VOMS scores may be due to several factors. First, the study participants had relatively mild CVS symptoms at baseline, which may have led to a floor effect in the VOMS assessment. Second, the intervention duration of 3 weeks may have been too short to produce substantial changes in vestibular ocular motor function. Third, the VOMS, although a validated screening tool, may need to be more sensitive to detect subtle changes in CVS. Future studies should consider using more comprehensive vestibular and oculomotor assessments, such as videonystagmography, dynamic visual acuity, and gaze stabilization tests.[33]

This study found similar effectiveness between FPHF and standard exercises. While standard exercises effectively reduce specific CVS symptoms, they may not address vestibular aspects. Future research should explore these interventions comprehensively, combining approaches to optimize CVS management in various populations and workplace settings. Limitations of this study include the homogeneity of the sample, mild CVS symptoms, and the short intervention period. Future studies should involve more diverse participants, have extended follow-up periods, and include individuals with pronounced vestibular ocular motor symptoms to better assess long-term efficacy and comprehensive impact.

Table 4. Comparison of vestibular ocular motor screening (VOMS) scores between the standard and the five points hand free (FPHF) exercise groups

Test/symptoms	Standard exercise group (n=31)			FPHF exercise group (n=31)		
	Pre Median (IQR)	Post Median (IQR)	Wilcoxon Signed Ranks Test	Pre Median (IQR)	Post Median (IQR)	Wilcoxon Signed Ranks Test
1. Baseline (pre-VOMS) symptoms						
Headache (0-10)	0 (0.00-3.00)	0 (0.00-0.00)	*p*=0.17	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.38
Dizziness (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.21	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.23
Nausea (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.32	0 (0.00-0.00)	0 (0.00-0.00)	*p*=1.00
Fogginess (0-10)	1 (0.00-4.00)	0 (0.00-1.00)	*p*=0.01*	0 (0.00-6.00)	0 (0.00-4.00)	*p*=0.08
2. Smooth pursuits						
Headache (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.79	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.71
Dizziness (0-10)	0 (0.00-3.00)	0 (0.00-0.00)	*p*=0.01*	0 (0.00-3.00)	0 (0.00-0.00)	*p*=0.02*
Nausea (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.18	0 (0.00-0.00)	0 (0.00-0.00)	*p*=1.00
Fogginess (0-10)	1 (0.00-1.00)	0 (0.00-0.00)	*p*=0.33	0 (0.00-2.00)	0 (0.00-0.00)	*p*=0.02*
3. Saccades – horizontal						
Headache (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.20	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.04*
Dizziness (0-10)	0 (0.00-0.20)	0 (0.00-0.00)	*p*=0.01*	0 (0.00-0.20)	0 (0.00-0.00)	*p*=0.68
Nausea (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.32	0 (0.00-0.00)	0 (0.00-0.00)	*p*=1.00
Fogginess (0-10)	1 (0.00-2.00)	0 (0.00-0.00)	*p*=0.06	0 (0.00-2.00)	0 (0.00-0.00)	*p*=0.02*
4. Saccades – vertical						
Headache (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.07	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.07
Dizziness (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.04*	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.29
Nausea (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.32	0 (0.00-0.00)	0 (0.00-0.00)	*p*=1.00
Fogginess (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.11	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.14
5. VOR – horizontal						
Headache (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.71	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.11
Dizziness (0-10)	0 (0.00-3.00)	0 (0.00-0.00)	*p*=0.01*	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.07
Nausea (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.66	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.32
Fogginess (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.44	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.21
6. VOR – vertical						
Headache (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.11	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.59
Dizziness (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.13	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.10
Nausea (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.32	0 (0.00-0.00)	0 (0.00-0.00)	*p*=1.00
Fogginess (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.55	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.26
7. VMS test						
Headache (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.07	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.32
Dizziness (0-10)	0 (0.00-2.00)	0 (0.00-0.00)	*p*=0.01*	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.21
Nausea (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.18	0 (0.00-0.00)	0 (0.00-0.00)	*p*=1.00
Fogginess (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.21	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.02*
8. Convergence						
Near point (CM.)	15 (7.00-22.50)	17.5 (15.00-22.50)	*p*=0.35	15 (9.00-17.50)	15 (10.00-21.50)	*p*=0.03*
Headache (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.18	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.10
Dizziness (0-10)	0 (0.00-3.00)	0 (0.00-0.00)	*p*=0.01*	0 (0.00-3.00)	0 (0.00-3.00)	*p*=0.72
Nausea (0-10)	0 (0.00-0.00)	0 (0.00-0.00)	*p*=0.18	0 (0.00-0.00)	0 (0.00-0.00)	*p*=1.00
Fogginess (0-10)	0 (0.00-1.00)	0 (0.00-0.00)	*p*=0.01*	0 (0.00-1.00)	0 (0.00-1.00)	*p*=0.03*

*p-value < 0.05; VOR, vestibular ocular reflex; VMS, visual motor sensitivity; IQR, inter-quartile range

Conclusions

The FPHF program demonstrated potential benefits in reducing CVS and vestibulo-ocular symptoms comparable to standard eye exercises. By targeting both visual and vestibular systems, it offers a promising approach for CVS treatment. However, this study found no statistically significant differences in effectiveness between FPHF and standard exercises. Both interventions improved CVS symptoms, suggesting that FPHF could be an effective alternative or complementary approach. Further research, including larger-scale randomized controlled trials with diverse populations and more extended follow-up periods, is needed to establish the long-term effectiveness and generalizability of FPHF. As digital device use continues to rise, exploring innovative interventions like FPHF presents new opportunities for managing CVS in the modern workplace.

Table 5. Comparison of cumulative score of the vestibular ocular motor screening (VOMS) between standard and the five points hand free (FPHF) exercise groups

VOMS Cumulative score (0-40)	Pre standard exercise	Post standard exercise	*p*-value	Pre FPHF exercise	Post FPHF exercise	*p*-value	*p*-value Post hoc with Bonferroni		
	Wilcoxon Signed Ranks Test			Wilcoxon Signed Ranks Test			Within Group SD	Within Group FH	Between group
1. Baseline VOMS[1]	4 (0.00-6.00)	0 (0.00-3.00)	0.02*	2 (0.00-9.00)	0 (0.00-5.00)	0.16	NS	NS	NS
2. Smooth Pursuits[1]	0 (0.00-5.00)	0 (0.00-0.00)	0.02*	0 (0.00-4.00)	0 (0.00-4.00)	0.02*	NS	NS	
3. Saccades-Horizontal[1]	0 (0.00-5.00)	0 (0.00-0.00)	0.00*	0 (0.00-4.00)	0 (0.00-0.00)	0.01*	0.01*	NS	
4. Saccades-Vertical[1]	0 (0.00-3.00)	0 (0.00-0.00)	0.06	0 (0.00-3.00)	0 (0.00-0.00)	0.02*	NS	NS	
5. VOR-Horizontal[1]	0 (0.00-5.00)	0 (0.00-0.00)	0.04*	0 (0.00-2.00)	0 (0.00-0.00)	0.03*	NS	NS	
6. VOR-Vertical[1]	0 (0.00-3.00)	0 (0.00-0.00)	0.07	0 (0.00-3.00)	0 (0.00-0.00)	0.03*	NS	NS	
7. VMS Test[1]	0 (0.00-5.00)	0 (0.00-0.00)	0.01*	0 (0.00-4.00)	0 (0.00-0.00)	0.04*	NS	NS	
8. Convergence	0 (0.00-5.00)	0 (0.00-0.00)	0.01*	0 (0.00-0.00)	0 (0.00-0.00)	0.14	0.01*	NS	
Near point mean (SD)	15.34 (7.68)	16.29 (5.88)	0.44	14.37 (6.61)	16.75 (7.53)	0.03*	-	-	

[1]Data presented in median (inter-quartile range, IQR) **p*-value < 0.05, VOR, vestibular ocular reflex; VMS, Visual Motor Sensitivity;

Disclosure

The authors declare no conflicts of interest related to this study.

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