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Combine effect of Ophthalmic exercise with Neck exercise on severity of Computer vision syndrome and Convergence insufficiency amongst IT professionals: an Experimental study

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Abstract

Background: Computer Vision Syndrome (CVS) and Convergence Insufficiency (CI) are common among IT professionals due to prolonged computer usage and poor ergonomic posture. These conditions lead to ocular discomfort, visual disturbances, and musculoskeletal symptoms, particularly neck pain. **Aim:** To evaluate the combined effect of ophthalmic exercises and neck exercises on the severity of Computer Vision Syndrome and Convergence Insufficiency among IT professionals. **Methodology:** An experimental study was conducted among 32 IT professionals aged 25–40 years in Gandhinagar city. Participants were randomly allocated into two groups of 16 each. Group A received ophthalmic exercises with ergonomic advice, while Group B received ophthalmic exercises combined with neck exercises and ergonomic advice for 4 weeks. Outcome measures included the Computer Vision Syndrome Questionnaire (CVS-Q) and Convergence Insufficiency Symptom Survey (CISS). Statistical analysis was performed using SPSS version 20.0. Wilcoxon Signed Rank Test and Mann–Whitney U Test were used for within-group and between-group comparisons respectively. **Results:** Both groups demonstrated significant improvement in CVS and CISS scores after intervention. In Group A, CVS scores improved significantly ($p=0.001$) and CISS scores showed highly significant improvement ($p<0.001$). In Group B, significant improvement was observed in CVS scores ($p=0.002$) and highly significant improvement in CISS scores ($p<0.001$). Between-group comparison showed no significant difference for CVS ($p=0.075$), whereas CISS showed a highly significant improvement in Group B compared to Group A ($p=0.012$). **Conclusion:** Combined ophthalmic and neck exercises with ergonomic advice are effective in reducing the severity of Computer Vision Syndrome and Convergence Insufficiency among IT professionals. The addition of neck exercises demonstrated greater effectiveness in improving convergence insufficiency symptoms.

Keywords: IT professionals, Neck exercise, Computer Vision Syndrome, Convergence insufficiency

1. Introduction

Computer vision syndrome defined by the **American Optometric Association** as "a complex of eye and vision problems related to activities, which stress the near vision and which are experienced in relation or during the use of computer." Computer vision syndrome include ocular symptoms, such as eye strain and irritation of the eyes, visual symptoms such as blurred vision, and musculoskeletal symptoms such as neck disability [1].

Study was carried out in Jamnagar in India to ascertain whether computer professionals had Computer Vision Syndrome, in which of the 1205 professionals surveyed, nearly half of them had it owing to the computer usage. The IT professionals using computer for more than 4 hours a day are susceptible to develop problems like computer vision syndrome [2].

On basis of these studies, we can say that computer vision syndrome occurs in people who are working on computer for longer period of time and most commonly in IT professionals but not only computer vision syndrome even **convergence insufficiency** can be seen among prolonged computer users. **Convergence insufficiency** is characterized by a decreased ability to converge the eyes and maintain binocular fusion while focusing on a near target. In this study she reported that Patients who are suffer from convergence insufficiency often complain of eye strain when reading, closing one eye when reading, or blurred vision after short periods of near work [3].

Ophthalmic exercise and Neck exercises are necessary which can correct neck posture among those people having altered neck posture due to working longer period of time on computer and among those people chronic neck pain show a weakening of their deep cervical flexors. This weakening of the deep cervical flexors causes a reduction in the intrinsic proprioceptors of the postural senses in the muscles, and it lowers the ability to control posture through interactions between the vestibular and visual systems [4].

2. Need of study

About 85 % of computer users suffer from Computer vision syndrome (CVS) and 70% of the total CVS cases are contributed by IT professionals.[10] There are studies which revealed that convergence insufficiency can be seen among people with computer vision syndrome and one of the study was done by Nidhi Tiwari et al. (2017), Showed that **Convergence insufficiency (CI)** is a common, yet not frequently diagnosed eye coordination problem in which the eyes drift outward when reading or doing close work. The superior cervical sympathetic ganglion surrounded by blood vessels and nerve networks and near the C2 vertebrae. When a condition of cervical instability exists, the vertebrae wander out of position-taking with them and stretching the area's veins, arteries, nerves, and nerve bundles.

According to **Beresford S M et.al (2007)** the use of eye exercises and stress reduction techniques during rest breaks to relieve CVS was first proposed by the author in his 1988 monograph "How to Stop Computer Stress or Eyestrain" **(Drs. Steven M et.al (1996)**. The use of eye exercises and rest breaks to relieve CVS was also proposed in the author's book "Improve Your Vision Without Glasses or Contact Lenses" [5].

John Albert (2005), Eye exercises have been purported to improve a wide range of conditions including convergence problems, ocular motility disorders, accommodative dysfunction, asthenopia, myopia, motion sickness, sports performance, visual field defects, visual acuity, and general well-being [11]

Pratibha Gaikwad (2021), reported that Neck setting exercises which include chin tuck exercise causes strengthening of deep flexor muscles which bring the head in proper alignment and isometric neck setting exercises along with eye exercises showed significantly better results than isometric neck setting exercises alone in improving intensity of pain and improving the score of quality of life on neck Disability Scale [6].

3. Aim:

Aim of the study is to see the combine effect of ophthalmic and neck exercise on severity of computer vision syndrome and convergence insufficiency symptoms amongst people working as IT professionals.

3.1 Objectives-

3.1.1 To see the Combine effect of Ophthalmic exercise and Neck exercise on severity of Computer vision syndrome among people working as IT professional

3.1.2 To see the Combine effect of Ophthalmic exercise and Neck exercise on severity on Convergence insufficiency among people working as IT professional.

4. Review of Literature

4.1 Sudip Poudel et al, 2020 conducted study on "Magnitude and Determinants of Computer Vision Syndrome (CVS) among IT Workers in Kathmandu, Nepal." A cross sectional study conducted among 263. Prevalence of CVS was 82.5 % of them 62.0 % participant were not aware about bad effects of computers to the visual apparatus. CVS symptoms included headache 48.0%, tired eyes 47.0% and eye strain 43.0%. Not taking breaks, not massaging eyes, unusual viewing distance, improper posture, computer usage for more than 10 hours/ day and not aware of CVS were significant predictors of CVS in IT workers [7].

4.2 Muthunarayanan Logaraj et al, 2013 conducted study on "Practice of ergonomic principles and computer vision syndrome (CVS) among undergraduates in chennai". A cross-sectional study was conducted among the undergraduate students. Study concluded that students who viewed the computer at a distance of less than 20 inches, viewed upwards or downwards to see the computer, who did not avoid glare and did not took frequent breaks were at higher risk of developing CVS. Students who did not used adjustable chair, height adjustable keyboard were at higher risk of developing neck and shoulder pain. The students who were not practicing ergonomics principle and did not check posture and make ergonomic alteration were at higher risk of developing CVS [8].

4.3 Julia T releaven et al, 2014 conducted study on "Characteristics of visual disturbances reported by subjects with neck pain". 70 subjects with neck pain and seventy healthy control subjects answered questions about the presence and magnitude – product of frequency and intensity of each of 16 visual symptoms noted to be associated with neck pain and other possible causes. The neck pain group had significantly ($P > 0.05$) greater prevalence and magnitude of 14/16 visual complaints and VCI (mean 27.4) compared to control subjects (mean 6.2). The characteristics of the visual symptoms were mostly consistent for those previously associated with neck pain. Subjects with traumatic neck pain had a significantly higher VCI compared to those with idiopathic neck pain [9].

5. Methodology

5.1 **Ethical approval**: Ethical approval for the study was taken from the Institutional Ethical Committee.
5.2 **Study design**: An Experimental Study
5.3 **Sampling method**: For the study, Convenient Sampling method was selected.
5.4 **Study population**: 25 to 40 years with persons who are working in IT industry.
5.5 **Study setting**: The study was conducted at Gandhinagar city.
5.6 **Study duration**: The study was completed over a period of 6 months.
5.7 **Sample size:** Total subjects: 32. Group A:16 subjects, Group B:16 subjects

5.8. Procedure:

The study was approved by the institutional ethical committee. 32 IT professionals were briefly stated about the nature of the study and informed written consent was taken before the procedure. Demographic data was collected which includes age, gender, work experience, working hours**.**

5.8.1 Criteria of selection:

5.8.2 Inclusion Criteria

Those who are Willing to participate in this study, both male and female, age between 25 to 40 years, Subjects who are working minimum 6 hours in a day and minimum 4 years of work experience

5.8.3 Exclusion Criteria

Persons who have already undergone any interventional program on eye and neck exercise, Computer users with detected eye disorders such as cataract, glaucoma, trachoma, Participants who is taking medication which has direct effect on eyes, Participants who have systematic illness were excluded.

Participants were divided into two groups with random allocation (16 participants in each group). Asked to fill up the computer vision syndrome questionnaire and convergence insufficiency symptom survey. Post and post intervention score was taken after 4 weeks.

5.9 Intervention

5.9a Group A Ophthalmic exercises and ergonomic advice
5.9b Group B Ophthalmic exercises with neck exercises and ergonomic advice

5.9a Group A OPHTHALMIC EXERCISE AND ERGONOMIC ADVICE [5], [10], [11], [12]
(10 repetitions, 2 times in a day. 3 times in a week for 4 weeks)

5.9a.1 Blinking- Closing the eyes, pausing for two seconds, then opening them again.
5.9a.2 Flexing- Look up without moving your head and then look down.
5.9a.3 Focusing Near and Far- This exercise can be done standing or sitting. Put your thumb in front of your face at about 10-inch distance and focus on it. Now focus on something else that is in your surrounding 10 feet away. Switch between near and far focusing repeatedly.
5.9a.4 Palming- Place your two hands over your eyes. The palm of hands should cover the eyes, the fingers on the forehead.
5.9a.5 Zooming- Raising your thumb in the hitchhikers position. Focus on the thumb and now draw it in until the thumb is three inches away from the face. Keep your focus on the thumb. Then slowly move the thumb and forearm back to the starting position.
5.9a.6 Figure of Eight- Staring at a blank wall, imagine a large figure 8 tilted on its side 10 feet away from you. Now trace this path of the figure 8 with your eyes without moving your head. Do this one way for a minute.
5.9a.7 20-20-20 Rule- Scheduling regular breaks can help to alleviate some of this strain. The 20-20-20 rule is easy to remember. For every 20 minutes of near work, look at a target 20 feet away for 20 seconds.
5.9a.8 Rest- Rest your eyes for 10 mins away from the screen for every 1 hour of work.
5.9a.9 Ergonomics for vision care : Size of characters on computer should not be too small to avoid strain, Sit 3 feet away from window, Monitor brightness should be equal to the area directly behind it, Lower the total light levels whenever possible to reduce glare on computer screen (remove or turn off some overhead lighting), Avoid placing monitor directly under cabinet task light, Close shades, curtains or blinds on window which

producing unwanted lights, Clean computer screen periodically to maximize clarity, Place computer screen at the appropriate reading distance from your eyes.

5.9b GROUP B OPHTHALMIC EXERCISES WITH NECK EXERCISES AND ERGONOMIC ADVICE

Subject is instructed to sit in the chair with arm support. Keeping rest of the body stable and relaxed. 10 repetitions, 3 times in a day, 4 times in a week for 4 week these exercises were given.

5.9b.1 Neck flexion: Bending head forward in full range of movement until chin touches sternum.

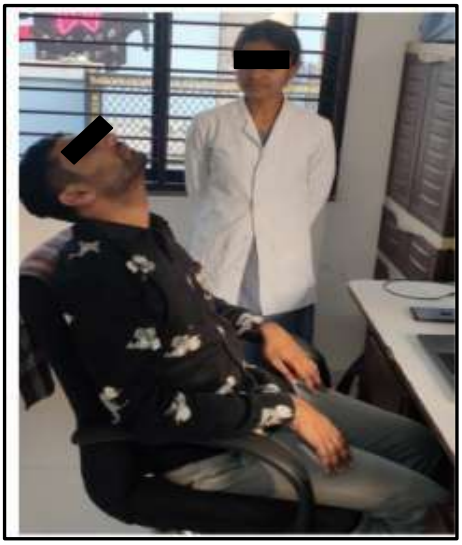
5.9b.2 Neck extension: Bending head backward in full range of movement until occiput touches neck.

5.9b.3 Neck rotation: Rotating neck from side to side until chin touches same shoulder.

5.9b.4 Neck side flexion: Bending head from side until earlobe touches shoulder.

5.9b.5 Chin tuck exercise: Start with keep a neck and shoulders in a relaxed position. Looked straight ahead. Then, gently glide a chin straight back – tuck chin to neck area. Not to move head up or down or bending neck forward. Hold that position for about 5 seconds. Bring your chin forward again.

Picture. 1 Group A Ophthalmic exercises



Picture. 2 Group B Neck exercises

Ergonomics for vision care: Size of characters on computer should not be too small to avoid strain. Sit 3 feet away from window. Monitor brightness should be equal to the area directly behind it. Lower the total light levels whenever possible to reduce glare on computer screen (remove or turn off some overhead lighting) Avoid placing monitor directly under cabinet task light Close shades, curtains or blinds on window which producing unwanted lights. Clean computer screen periodically to maximize clarity. Place computer screen at the appropriate reading distance from your eyes.

6. Outcome Measures

6.1 COMPUTER VISION SYNDROME QUESTIONNAIRE [4]-CVS-Q questionnaire to measure the prevalence of CVS and its symptoms. The CVS-Q questionnaire measures the frequency of the symptoms with the response options of "never," "occasionally," and "often or always. If the participants report having symptoms "occasionally," or "often," they will be asked to rate the intensity of the symptoms, choosing between the options "moderate" or "intense." rating scale of 0-3 points, with the following categories: Never=0, Occasionally=1 (sporadic episodes or once a week), Often=2 (two or three times a week), Score: frequency of symptoms, intensity of symptoms. If the total score is ≥6, then the participant is considered to have CVS. Reliability: 0.80.

6.2 CONVERGENCE INSUFFICIENCY SYMPTOM SURVEY [6]- The Convergence Insufficiency Symptom Survey (CISS) was designed to quantify the severity of symptoms associated with convergence insufficiency (CI). The CISS questionnaire was scored as usual on a 5-point scale with 0 = never, 1 = infrequently (not very often), 2 = sometimes, 3 = fairly often, 4 = always. CISS score of ≥21 was used to define 'significant' symptoms, and convergence insufficiency. Reliability: 0.88, CISS is a valid and reliable outcome measure

7. Results

Data was analyzed by Statistical Package of Social Science (SPSS) version 20.0 was used and before applying statistical test normality of the data was checked by the Shapiro wilk test, p value is < 0.05 so, data is not normally distributed. As the data is not normally distributed non -parametric test is used for analysis. In this study power was kept at 80% and level of significance was kept at 95%.

Table 7.1: Age distribution in both Groups

AGE	GROUP A	GROUP B
MEAN (YEARS)	28.18	28.68
SD	1.32	1.19

Table 7.2: Gender distribution in both Groups

GENDER	GROUP A	GROUP B
MALE	9	10
FEMALE	7	6
TOTAL	16	16

The table 1 shows the group statistics of age distribution among 32 subjects the mean age of the 16 participants in group A was 28.18 years with standard deviation 1.32. In the group B, the mean age was 28.68 years with standard deviation 1.19.

Table 7.3: Work experience of participants

YEARS	GROUP A		GROUP B	
	N	%	N	%
0-5 YEARS	14	87%	12	75%
6-10 YEARS	2	13%	4	25%
>10 YEARS	-	-	-	-
TOTAL	16	100%	16	100%

Table 7.4: working hours in both groups

WORKING HOURS	GROUP A	GROUP B
MEAN (HOURS)	7.43	7.56
SD	0.81	0.72

The table 7.4 shows the group statistics of working hours among 32 subjects the mean working hours of the 16 patients in group A was 7.43 hours with standard deviation 0.81. In the group B, the mean age was 7.56 with standard deviation 0.72. Table 7.5 shows the effects of intervention on outcome measures CVS and CISS before and after exercise within Group A and Group B, Wilcoxon Signed Rank Test was used. To analyze the comparison between effect of Ophthalmic exercise and Ophthalmic exercise with neck exercise on CVS and CISS between both groups, Mann Whitney U Test was used.

Table 7.5: Tests to Compare Outcomes

OUTCOME MEASURES	TEST USED TO COMPARE WITHIN GROUP A	TEST USED TO COMPARE WITHIN GROUP B	TEST USED TO COMPARE BETWEEN GROUP A AND B.
CONVERGENCE INSUF-FICIENCY SYMTOM	WILCOXON SIGNED RANK TEST	WILCOXON SIGNED RANK TEST	MANN WHITNEY U TEST
COMPUTER VISION SYN-DROME	WILCOXON SIGNED RANK TEST	WILCOXON SIGNED RANK TEST	MANN WHITNEY U TEST

Table 7.6: Comparison of Pre and Post treatment score of Computer vision syndrome (CVS) within Group A

Computer Vision Syndrome	Pre-Test		Post-Test		Group A	
	Mean	Sd	Mean	Sd	Wilcoxon Test	P Value
	6.44	0.63	4.75	1.24	3.46	0.001

Data was not normally distributed, Wilcoxon signed rank test was used to comparison of pre and post treatment score of CVS P value of CVS is 0.001, considered significant difference.

TABLE 7.7: Comparison of Pre and Post treatment score of Computer vision syndrome (CVS) within Group B

Computer Vision Syndrome	Pre-Test		Post-Test		Group B	
	Mean	Sd	Mean	Sd	Wilcoxon Test	P Value
	6.69	0.48	5.63	0.96	3.15	0.002

Data was not normally distributed, wilcoxon signed rank test was used to comparison of pre and post treatment score of CVS within group B. For group B : P value of CVS is 0.002, considered significant difference

Table 7.8: Comparison of Pre And Post Treatment Score Of Convergence Insufficiency Symptom (CIS) Within Group A

Convergence Insufficien Symptom	Pre Test		Post Test		Group A	
	Mean	Sd	Mean	Sd	Wilcoxon Test	P Value
	6.38	3.79	4.81	3.73	3.62	<0.001

Data was not normally distributed, wilcoxon signed rank test was used to comparison of pre and post treatment score of CIS within group A. For group A : P value of CISS is < 0.001, considered highly significant difference.

Table 7.9: Comparison of Pre and Post Treatment Score Of Convergence Insufficiency Symptom (CIS) Within Group B

Convergence Insufficiency Symptom Survey	Pre Test		Post Test		Group B	
	Mean	Sd	Mean	Sd	Wilcoxon Test	P Value
	13.75	7.68	11.31	7.45	3.55	<0.001

Data was not normally distributed, wilcoxon signed rank test was used to comparison of pre and post treatment score of CISS within group B. For group B : P value of CISS is < 0.001, considered highly significant difference.

Table 7.10: Mean difference of CVS within group A and group B.

Group A - B		**Mean**	**Sd**	**Man Whitne Test**	**P Value**
Computer Vision Syndrome	Ophthamic Exercise	1.69	0.95	83.5	**0.075**
	Ophthalmic Exercise Neck Exercise	1.06	0.77		

Data was not normally distributed, Mann whitney test was applied for comparison of mean difference of CVS between Group A and Group B. P value of CVS is 0.075, considered not significant difference between both groups.

Table 7.11: Mean Difference of CIS Within Group A And Group B.

Group A - B		Mean	Sd	Man Whitney Test	P Value
Convergence Insufficiency Symptom	Ophthamic Exercise	1.56	0.89	65	**0.012**
	Ophthalmic Exercise + Ne Exercise	2.44	1.09		

Data was not normally distributed, Mann whitney test was applied for comparison of mean difference of CISS between Group A and Group B. P value of CISS is < 0.012, considered highly significant difference between both groups.

8. Discussion

In this study, participants who have undergone intervention of combine effect of ophthalmic and neck exercises with ergonomics on computer vision syndrome have found the significant effect between pre and post intervention but there is not significant difference between control and intervention group.

Eye exercises improve the performance of muscular and motor activities of the eyes. From the statistical analysis it was found that this eye exercises and neck exercise is very effective in reducing eye strain and neck pain etc. These exercises help in relaxing the ocular muscles, some exercises like palming will give relaxation to all sensory nerves related with vision. The greater effects of eye exercise were found in improvement of NPC in myopia. It may be due to the fact that in eye focusing exercise, the lenses convergence and relaxes, thus it affects the power of accommodation and with proper practice of eye exercise, it improves the accommodation power this would result in better improvement of NPC.

Pratibha Gaikwad, (2021), concluded that Additional effect of eye exercises along with neck setting exercises might have caused increase in blinking activity and strengthening of ciliary muscles that leads to less work-related eye straining that in turn causes decrease in visual as well as musculoskeletal load. Neck exercises causes strengthening of deep flexor muscles which bring the head in proper alignment [6].

There is highly significant effect on convergence insufficiency in intervention group B and also in group A. There is highly significant difference between both groups but according to mean difference it concluded that combine effect of ophthalmic exercises and neck exercises with ergonomics is more effective on convergence insufficiency than only ophthalmic exercises with ergonomics.

9. Conclusion:

Combine effect of Ophthalmic exercise with Neck exercise is effective on severity of computer vision syndrome and convergence insufficiency among IT workers.

10. Limitations

The outcome measures were subjective and there was no comparison with objective outcomes. Sample size was less.

11. Future recommendations

- Future Studies can be done with more duration of intervention program.
- Other intervention program can be included for future studies.

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