



Research Article

INFLUENCE OF BATES EXERCISES AND CUSTOMIZED VIDEO GAMES ON POSTURAL INSTABILITY IN COMPUTER VISION SYNDROME

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ABSTRACT

Objective: To determine the effects of customized video games bates exercise on postural instability caused by altered vision in computer vision syndrome.

Method: Total 60 patients between ages 18-40, both males and females having C.V.S-Q score more than > 6 were randomly allocated to Group A, Group B, Group C respectively. Pre-test readings were taken for average deviation of antero-posterior Sway(A.P) and Latero-lateral sway on force Platform win-track medicaptours. Computer vision questionnaire (during inclusion criteria) was measured to check for level of severity of symptoms in computer vision syndrome. Group A received Customized video games along with ergonomics advice, Group B received Bates exercises along with ergonomics advice, and Group C received ergonomics advice alone. Intervention was given three times in a day for 4 weeks.

Result: There was a statistical significant difference of pre-post reading of antero-posterior sway as well as Latero-lateral sway(Eyes open and eyes close) in both Group A and Group B(within group) and for Group C there was a statistical significant difference of pre-post reading only for latero-lateral eyes close, however there was no statistical significant difference of pre post reading for antero-posterior(Eye open and close) as well as Latero-lateral sway(eyes open). Between the Groups there was a statistical difference of post-test reading of Antero-posterior sway and Latero-lateral sway(Eyes open and eyes close) between Group A and C and Group B and C. There was no statistical difference of post-test readings of A.P and L.L sway between Group A and Group B, but there is statistical significant difference of post-test readings of C.V.S-Q between Group A and B, thereby indicating Group B more effective in all parameters from Group A.

Discussion - Customized video games and bates exercise along with ergonomics both are beneficial in improving postural instability due to altered vision and musculoskeletal disorders in computer vision syndrome.

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INTRODUCTION

Eyes is a sensory organ which is responsible for vision, collecting and focusing light. It plays a major role in encoding the first neural signals, to visual pathways^(1, 2) It also has an essential contribution in the balance, because human balance is controlled by three distinct on segregated sensory system i.e. visual, vestibular and somatosensory respectively.⁽³⁾ Human eye ball diameter is about 24mm having two segments: an anterior part and posterior part.⁽⁴⁾

If someone spends 2 hours daily on computer then he have 90% chance to get computer vision syndrome.

However, Computer vision syndrome (CVS) have a remarkable influence not only on the visual comfort but also for occupational work rate.^(5, 6) Symptoms of the computer vision syndrome are: double vision, eye-irritation, blurred vision, watery eyes, poor focusing, eye strain, tired eyes, contact lens problem presbyopia, sore eyes, dry eyes, neck, back and shoulder pain.⁽⁷⁾

Computer professional's, bankers and account section workers that experienced excessive near work by mobile, laptop or tab are more often affected by C.V.S. Practicing ergonomics is a crucial part of education while working on computer for individuals having musculoskeletal disorders due to inappropriate ergonomics and extensive usage of electronic gadgets.^(8, 9)

Visual effort is more when viewing the computer screen as compared to that when viewing to the paper, because of the

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fact that blinking of eyes is twenty two times per minute when viewing at paper which decreases to seven times blink per minute while viewing at the computer screen.⁽¹⁰⁾

MATERIALS AND METHODOLOGY

Study Design

Randomized Control Trial

Study Setting

The study would be conducted in the UNI-hospital, Department of Physiotherapy, Lovely professional university and Punjab.

Populaton and Sampling

Total 60 samples were selected and randomly assigned into 3 groups that is 20 in each.

Selection Criteria

Inclusion Criteria

- Age group 18-40
- Both (Male and Female)
- CVS-Q (scored >6)

Exclusion Criteria

- Blind
- Cataract
- Any eye surgical history
- Diabetic neuropathy
- Nystagmus
- Head injury
- Stroke

Parameters

- Postural instability and average deviation of anterior-posterior sway and latero-lateral sway is recorded
- Computer vision syndrome questionnaire

Instruments and Tool

- Customized video game
- Win track / force platform

Procedure

After fulfilling the inclusion and exclusion criteria (where pre-readings for CVSQ questionnaire was measured) a written consent was taken by each subject participating in the study. The subjects were randomly allocated into three groups i.e. Group A (customized video game, ergonomics), Group B (Bates exercises, ergonomics) and Group C (ergonomics advice). The Pre- test readings of subjects for postural instability (i.e. antero-posterior sway eyes open and eyes close, latero- lateral eyes open and eyes close) was measured win track medicaptors. During the test, subjects were asked to maintain a target on wall and maintain an upright and standardized Romberg position (feet placed side by side forming an angle of 30°) with both heels separated by almost 4cm. The subjects were asked to maintain a stance position on force platform for around 30 seconds that is arm should be kept side by side while breathing normally, not to clench teeth or even speak during stance position. For the Romberg test, subjects were asked to perform two tests, one in eye open and other in eye close. The distance between the subjects and the

target was 40cm. Follow-up was taken after 4 weeks of intervention and post readings were taken to compare pre and post values to see the degree of improvement.



Figure 1 Average deviation of antero-posterior and latero-lateral sway both in eyes open and close

Intervention

Group A: Customized video games and ergonomics advices

1. Blinking of eyes. (5 reps)
2. Focusing the ball, and moving the eyes up and down, side to side (10 reps each).
3. Focusing the ball and moving the eyes left up and right down & eyes right up and left down (10 reps each).
4. Focusing and tracing the ball with eyes clockwise and anti-clockwise (10 reps).
5. Zooming in and out of ball(10 reps).
6. Focusing and tracing the ball with eyes in figure of eight (10 reps).
7. Focusing and Tracing ball with eyes in vertical direction&in horizontal direction(10 reps each).
8. Focusing two balls simultaneously to midline up to nose level(10 reps).

All exercises to be done thrice a day for 4 weeks.

Group B: Bates exercise and ergonomics advice.

1. Turn the eyes far to the left and then to the right. (10 reps).
2. Turn and stretch the eyes in upward direction and in downward direction. (10 reps).
3. Raising the eyes look obliquely to the left in upward direction then obliquely down to the right. (10 reps).
4. Raising the eyes obliquely to the right up and obliquely down to the left. (10 reps).
5. Trace around the figure of eight image to up, middle and to the left first. (10 reps).
6. Opening and closing of the eyes (10 reps)
7. Clockwise and anticlockwise rotation of the head with eye movement. (10 reps).
8. Bringing both eye ball towards nose. (2-4 reps).
9. Keep the image on wall of the room at distant space, then trace the lines from top to bottom or side to side as in the image. (10 reps).
10. Trace with the eyes along the spiral line in the image and continue tracing anticlockwise and clockwise with eyes and then blink (10reps).
11. Align a pencil between left and right eyes see the tip of the pencil first. Then shift to distinct object and then look back to the pencil tip. (10 reps).

12. Keep one palm over an open eye but eyes should be open then with the other eyes which was uncovered with the palm look at the nose tip then shift the gaze to the distinct object and then look back to the nose tip(10 reps).
13. First try to see the nose tip with both eyes simultaneously, then shift the gaze to some distinct object then look back to the nose tip.
14. Pupil exercises–first look at the blank page in the dark room then turning the light off and on with frequent break of three seconds. Perform the exercise for at least one minute (2-4 reps).
15. Face the sun and pull the upper eyelid in such a way that sunlight should fall on the sclera but not on the pupil of the eye .pull the lower eyelid for sunlight to fall on sclera, but not on the pupil(one rep).
16. Face towards the sun with eyes closed and move the head to side to side (one rep).
17. Do upward and downward movement of the eyes by placing the two fingers on each side of the eye ball, without applying any kind of pressure to the eyes (10 reps).
18. Resistance eyes exercises is done by partially closing of the right eye and placing the forefinger at right side of the eye, then turn the eyeball towards right side of the forefinger and resist that movement with slight pressure (10 reps).
19. Imagine looking over the right and left shoulder first do this without moving the head. Then, imagine looking right and left side and move eyes with head movement.

All exercises should be done thrice a day except exercise 15 and 16(only once in day time) for 4 weeks.

Group C: Ergonomics advice

1. Screen should be viewed within the normal cone of vision(0-30°)and Ears ,shoulders and hips line up vertically with elbows bent at 90°angle while using keyboard (rang 70°to 110°),upper arm pointing to the floor.
2. Elbows bent at 90°whie using mouse, hips as far back on chair as possible and bent at 100°-120° with no sharp edges pressing onto wrist and monitor should be at proper viewing distance.
3. Adequate thigh and leg clearance with knees bent at a 90°angle, (range70°-110°) and feet supported.

Group A

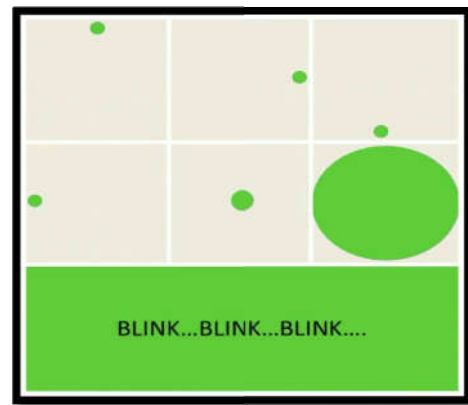
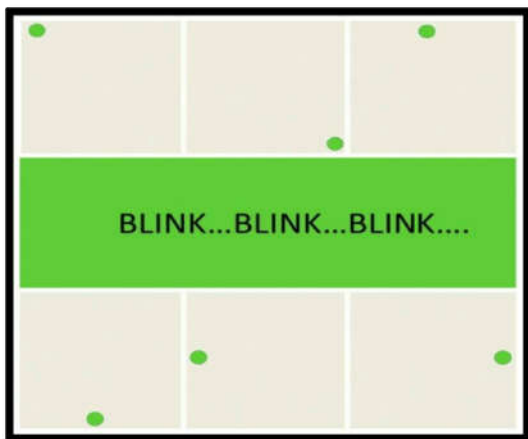


Fig 2 customized video games



Figure 3 Bates exercise which include all the said exercises

DATA ANALYSIS AND RESULT

Statistics were performed using SPSS Software 20.0 Level of significance selected for the study p<0.05

Table 1 Mean and standard deviation of age, weight, height and foot size of the subjects for Group A, Group B and Group C

	Group A	Group B	Group C	T	P value
Age Mean ± SD	21.85 ± 2.700	21.60 ± 2.741	22.45 ± 2.212		0.563
Wt. Mean ± SD	56.40 ± 9.383	60.55 ± 9.087	57.30 ± 10.628		0.371
height Mean ± SD	158.45 ± 6.724	159.15 ± 6.675	160.70 ± 7.692	3.159	0.589
Foot size Mean ± SD	22.75 ± 1.482	23.30 ± 1.658	22.70 ± 1.780		0.446

The Mean age, weight, height and Foot size of Group A, Group B & Group C showed no significant difference between groups.

Table 2 Comparison of mean difference of pre and post CVS-Q score within Group A, B and C

	Pre Mean ± SD	Post Mean ± SD	Improvement Mean ± SD	P value	t value
Group A	12.50 ± 7.543	6.70 ± 2.812	5.80	0.001	3.985
Group B	12.20 ± 2.648	5.25 ± 1.682	6.95	0.000	10.549
Group C	10.60 ± 2.521	10.50 ± 2.685	0.10	0.5777	0.568

The Mean and S.D of CVSQ score for Group A, Group B showed a significance difference in CVSQ score between pre and post intervention in both the Groups

The Mean and S.D of CVSQ score for group C was showed no significance difference in CVSQ score between pre and post intervention in Group C

Table 3 Comparison of mean difference of antero-posterior sway with eyes open (EOAP) within Group A, B and C

	Pre Mean ± SD	Post Mean ± SD	Mean difference	P value	t value
Group A	4.52 ± 3.425	1.80 ± 0.750	2.72	0.002	3.491
Group B	3.36 ± 1.924	1.78 ± 1.309	1.59	0.000	5.369
Group C	3.99 ± 3.052	3.38 ± 2.705	0.61	0.486	0.711

The Mean and S.D of (EOAP) for Group A & Group B showed a significance difference in (EOAP) between pre and post intervention in both the Groups.

The Mean S.D of (E0AP) for group C showed no significance difference in (EOAP) between pre and post intervention in Group C.

Table 4 Comparison of Mean difference of pre and post Antero-posterior sway with Eyes close (ECAP) within Group A, Group B, Group C

	Pre Mean ± SD	Post Mean ± SD	Improvement Mean ± SD	P value	t value
Group A	4.25±1.931	1.96±0.944	2.29	0.000	5.834
Group B	3.61±3.139	2.12±1.063	1.50	0.041	2.196
Group C	5.85±6.098	3.07±1.544	2.78	0.070	1.917

The Mean and S.D of (ECAP) for Group A & Group B showed a significance difference in (ECAP) between pre and post intervention in both the Groups.

The Mean and S.D of (ECAP) for group C showed no significance difference in (ECAP) between pre and post intervention in Group C.

Table 5 Comparison of Mean difference of pre and post Lateral-lateral sway with Eyes open (EOLL) within Group A, Group B, Group C

	Pre Mean ± SD	Post Mean ± SD	Mean differences	P value	t value
Group A	6.94±4.223	2.63±1.259	4.31	0.000	4.976
Group B	4.14±3.128	1.681±0.989	2.46	0.000	4.197
Group C	5.66±4.122	4.71±3.135	0.95	0.360	0.938

The Mean and S.D of (EOLL) for Group A & Group B showed a significance difference in (EOLL) between pre and post intervention in both the Groups.

The Mean and S.D of (EOLL) for group C showed no significance difference in (EOLL) between pre and post intervention in Group C.

Table 6 Comparison of Mean difference of pre and post Lateral-lateral sway with Eyes close (ECLL) within Group A, Group B, Group C

	Pre Mean ± SD	Post Mean ± SD	Improvement Mean ± SD	P value	t value
Group A	6.97±6.184	2.66±1.155	4.31	0.003	3.379
Group B	4.69±2.605	2.36±1.423	2.34	0.000	4.256
Group C	7.46±9.116	3.08±1.601	4.38	0.031	2.33

The Mean and S.D of (ECLL) for Group A, Group B & Group C showed a significance difference in (ECLL) between pre and post intervention in all the three Groups.

DISCUSSION

There is statistical significant improvement after post intervention within Group A for C.V.S-Q score. Anterior – posterior sway eye open, Antero-posterior sway eyes close, lateral – Lateral sway eyes close. The significant improvement is due to the customized video games along with the ergonomics. For Group A pilot study was conducted on 10 patients to see the effects of customized video games which was design to improve vision thereby indirectly improving the postural instability and study show the significance difference (for 10 sample size) in C.V.S-Q score, Anterior-posterior sway eyes close, Lateral –lateral sway eyes open, latero-lateral sway eyes close but show insignificant difference for antero-posterior sway eyes open.

One of the study that was conducted by Gideon p. et al on effect of carrot sticks or joysticks video games on vision and

concluded that contrast sensitivity can be improved simply by playing video games and ultimately lead to improved vision and beyond that which can be provided by corrective lenses⁽¹¹⁾ For Group C there is insignificant difference within group for C.V.S.Q, Antero-posterior sway eyes open, Antero-posterior sway eyes close, latero-lateral sway eyes open, but showed a significant result for latero-lateral eyes close.

On comparing between Groups A, Group B, Group C there is only significance difference in C.V.S.Q and latero-lateral sway eyes open and is insignificant for other parameters. (Table 1-6) The current study shows a significant improvement after post intervention within Group B for C.V.S-Q Score. Antero-posterior sway eyes open, Antero-posterior sway eyes close Lateral –lateral sway eyes open, lateral –lateral sway eyes close. The significant improvement was due to the Bates method along with ergonomics. Bates method leads to coordination of eye muscle function, activates relaxation and contraction of the eyes muscles as it is the natural way to keep the muscle strong and thereby improving the visual acuity.⁽¹²⁾

Limitations

- Sample size was small in the present study.
- Follow up should be for longer durations, to check for long term effects.
- Postural assessment as well as CVSQ questionnaire should be taken week wise.

Future Suggestions

- Study should be conducted for larger sample size and for longer durations.
- For sample size selection optometric parameter should be there.
- Future study should be done in pediatric and geriatric population.

CONCLUSION

The present study illustrates significant improvement for postural instability in computer vision syndrome by bates and customized video games. Both the interventions along with ergonomics are beneficial in improving postural instability in computer vision syndrome.

Ethical Approval

Ethical approval was taken from the Project Approval Committee, with registration number 11500723 Department of Physiotherapy, Lovely Professional University.

Conflict of Interest

There is no conflict of interest of any sort.

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