

Effectiveness of Bates Eye Exercise for Visual Fatigue in Mobile Phone Using College Students

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Abstract

Aim: To find out the effectiveness of bates eye exercise among mobile phone using college students.

Background: Since there is high level of prevalence of smartphone users (i.e., 37%) is between the age group of 16-24 years, so there might be more chances of developing digital eye strain among this population.

Study Design: Pilot study.

Methods: In this study 15 samples were taken who satisfied the inclusion criteria. The mean age group of samples is 21.66 years. Bates eye exercises such as palming, resting the eyes, eye massage, blinking, shifting, sun treatment, and central fixation are some of the exercises that gives relaxation to ocular muscles are given to the subjects. Asthenopia questionnaire, perceived stress scale, and Snellen chart were used as outcome tool to take pre and post-test.

Results: The statistical analysis of pre & post- test values were analyzed using paired and unpaired 't' test. The result of this study shows that Bates eye exercise has significant effect in near induced transient myopia and very significant in reducing the visual fatigue. But it has no significant effect in reducing the mental strain in this study.

Conclusion: From this study it has been concluded that there is significant effect of Bates eye exercise in reducing visual fatigue and near induced transient myopia in smartphone using college students.

Keywords: Smartphone Usage, Visual Fatigue, Asthenopia Questionnaire, Bates Eye Exercise.

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Introduction

“Eye is the Window to Our Body”

Vision is the highly developed sense that present in our body [1]. Eighty to eighty-five percent of our perception, learning, cognition, and activities are mediated through vision [2]. It acts as a tool to capture the things like a camera and stores it in the brain. Good vision is a key factor for living a healthy and happy life.

Twenty first century is an era of digital world in which the smartphone plays the significant role in everyone's day to day life. It gives instant solution to all our questions. The main function of mobile phone is for calling and sending messages, apart from this it is used for various functions such as internet browsing, social media participation, bill payments, for playing games etc., According India cellular and electronics association [ICEA], 500 million smartphone users were reported at the end of 2019 in India; By 2021, it is expected to be 829 million users [3]. Smartphone addiction may harm our health physically as well as psychologically. Excessive use of smartphone will lead a kind of

anxiety in users which is due to the flow of news that they go through. [16] This anxiety will itself causes eye strain. [15] Certain other causes including poor lighting, glare on a digital screen, improper viewing distance, poor seating posture, and uncorrected vision problems. [11]

According to international classification of disease (ICD-10) of the WHO, visual fatigue is also called visual strain. [8] Fatigue is defined as a failure to maintain a required force or output of power during sustained or repeated muscle contraction or as time-related deterioration in the ability to perform certain mental task. [9] According to American optometric association, Digital eye strain (DES) is a group of eye and vision related problems that results from prolonged computer, tablet, E- reader and cell phone use. [5] Eye strain, headaches, blurred vision, Dry eyes, pain in the neck and shoulders are the symptoms of digital eye strain. [11] Asthenopia is a formal term for eye strain. It has been reported that 43 percentage of college students having symptoms of eye strain who used

mobile phone for at least 2 hours/ day. [10] The symptoms may be even worse and faster in case of smartphone than other digital devices like computer, television etc., since, the relatively small screen and font size of the mobile phone may necessitate us to use it in close distance. [12] As a result of this, there occurs increased accommodation demand, eyelid squinting, orbicularis muscle load, and increased blood flow. This leads to blurred vision, eye heaviness, tired eyes and headache. [13] Eye muscles are the busiest working muscle of our body. [7] Prolongation of near work of mobile phones will need a constant contraction of ciliary eye muscles which will later lead to spasm of ciliary muscles. When it failed to relax the lens

cannot return to its focus which may cause blurred vision for distant objects which is also referred to as “Pseudo myopia” or “near induced transient myopia”. Hence, one who uses mobile phone at near distance consistently are more likely to develop myopia due to spasm of ciliary muscle. [17] In this study, Bates eye exercise is used to treat the visual fatigue. Resting the eyes, palming, eye massage, blinking, shifting, sun treatment, and central fixation are some of the exercises that give relaxation to ocular muscles. Thus, the main focus of this study is to relieve visual fatigue and to prevent further progression to myopia. [14,15]

Anatomy

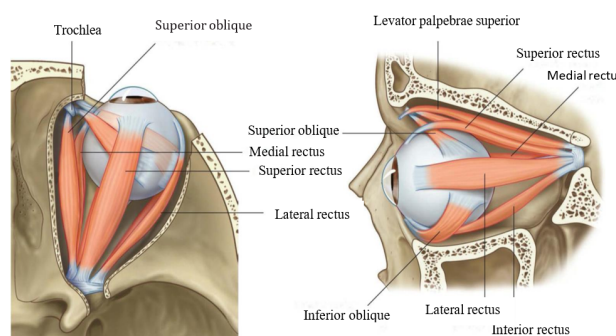


Figure 1: [6]

There Are Two Groups Of Muscles Within The Orbit:

Extrinsic Muscles of eyeball (extra-ocular muscles) involved in movements of the eyeball or raising upper eyelids. The extrinsic muscles include the levator palpebrae superioris, Rectus (superior, inferior, medial, and lateral), Oblique (superior and inferior).

Intrinsic Muscles within the eyeball, which control the shape of the lens and size of the pupil. The intrinsic muscles include the ciliary muscles, the sphincter pupillae, and the dilator pupillae. The ciliary muscle consists of smooth muscle fibers arranged longitudinally, circularly, and radially. Controlled by parasympathetics on contraction, decrease the size of the ring formed by the ciliary body. Fibers arranged in a circular pattern make up the sphincter pupillae muscle which is innervated by parasympathetics-contraction of its fibers decreases or constricts the pupillary opening. Fibers arranged in a radial pattern make up the dilator pupillae muscle, which is innervated by sympathetics-contraction of its fibers increases or dilates the pupillary opening. [6]

Need of the Study:

In the recent studies eye exercise are given to refractive errors alone and no study have suggested Bates ophthalmic exercises for visual fatigue. Since it has been reported that 44% of college students are

having eye strain due to overuse of smartphones, which has been expected to be reduced with ophthalmic exercises and this may prevent further progression of eye strain to myopia.

So, the need arises to find out the effectiveness of bates eye exercises for visual fatigue among mobile phone using college students.

Aim of the Study: The aim of this study is to find out the effectiveness of Bates eye exercises for visual fatigue among mobile phone using college students.

Objective of the Study

- To find out the subject with visual fatigue.
- To find out the effectiveness of Bates eye exercises in reducing visual fatigue.
- To find out the effectiveness of Bates eye exercises in reducing near induced transient myopia.
- To find out the effectiveness of Bates eye exercises in reducing mental strain.

Hypothesis

Research Hypothesis: Bates eye exercise is effective in reducing the visual fatigue among smartphone using college students.

Null Hypothesis: Bates eye exercise has no significant effect in reducing the visual fatigue among smartphone using college students.

Alternate Hypothesis: Bates eye exercise has significant effect in reducing the visual fatigue among smartphone using college students.

Materials and Methodology:

Study design: Pilot study.

Study setting: Parbhani College of Physiotherapy.

Study population: College students.

Sampling technique: Convenient sampling.

Sample size: 15 samples.

Study duration: 6 months.

Training duration: 8 weeks

Materials Used:

- Snellen chart
- Inch tape
- Chair
- Table
- Timer
- Questionnaire forms

Outcome Tools:

1. Snellen chart
2. Asthenopia questionnaire form
3. Perceived stress scale

Selection Criteria:

Inclusion Criteria:

- Students using mobile phone for at least 2 hours / day.
- Students having mild to moderate asthenopia score.
- Students having mild to moderate stress in perceived stress scale

Exclusion Criteria:

- Students using or already used power glasses.
- Students already practicing any other eye related exercises.
- Those who undergone any eye surgeries.
- Those with any eye disease, eye injury or congenital eye conditions.

Procedure

Subjects who satisfied the inclusion criteria were included in this study. The benefits of the study and treatment intervention was explained to the subjects and a written informed consent was taken. The subjects were assessed using Snellen chart, asthenopia questionnaire form, and perceived stress scale. Convenient sampling is done.

Assessment Procedure



Figure 2:

Asthenopia Questionnaire form was given to the subject to assess the symptoms of visual fatigue.

It consists of 10 questions and each symptom is graded from 0 to 6, where 0- none and 6-more severe. Perceived Stress Scale consists of 10 questions in which the subjects were asked to grade

each question for 0 to 4 based on their experience on last one month, where 0 indicates 'never' and 4 indicates 'very often'.

PSS score obtained by reversing responses to the four positively stated items (2,4,5, and 10) and then summing across all scale items.



Figure 3:

Snellen chart is used to assess the ocular muscle spasm induced by near work with mobile phone. The chart is pasted in a well-lighted room and the subject is made to stand at the distance of 20 feet away from the chart.

The subject is then asked to read each row in the Snellen chart from top to bottom. Initially with one eye open and another eye closed, vice versa; then with both the eyes.

Exercise Procedure

The exercises were taught to the subject by the therapist and asked to do the exercises twice a day; 3 minutes for each exercise; for 2 months.

Therapist position: sitting.

Patient position: comfortable sitting.

1) Breathing exercise:

When we are under stress, we take shallow and short breaths. Relaxed breathing will improve oxygen supply to our body which soothes our nervous system.

Taking long and deep breaths will relaxation to our mind.

- Drop your shoulder and arms on the side loosely.
- Inhale slowly for 5 counts and exhale for 10 counts.
- Let all the thoughts out while doing exhale.

2) Resting the eyes:



Figure 4:

Just close your eyes and think about something that makes you happy, it may give you temporary relief from the eye strain.

3) Palming: A greater degree of rest can be obtained by closing and covering the eyes so as to exclude all

the lights. Close both eyes and then cover them with the palm of both hands, the fingers crossed over the forehead.

Make sure that the hand placed over your eyes should not create any pressure in eyes.

**Figure 5:****4) Massage:**

The physical and mental tension that are caused by poor posture, lack of movements, poor home or environment are tend to collect in the areas like upper back, neck, face and areas around eyes. We can relieve this tension by doing certain self-massages.

- 1) Find a comfortable place to sit and take a deep breathing.
- 2) Reach around with your right hand to your left neck and shoulder areas and massage the muscles. Do the same with the left hand on your right neck and shoulder areas.

- 3) Massage the inside eyebrow corners with your thumbs, and use your other fingers slightly curled against your forehead to massage your forehead.

- 4) Use your thumb and index finger to massage the bridge of your nose by pressing downward, then upward. Place your thumbs on your lower jaw and place your index and middle fingers against both sides of your nose near the nostrils. Use your index and middle finger to massage these areas. Lower your middle fingers and massage the same areas with your index fingers.

- 5) With your fingers curled under and your thumbs on each side of your forehead, use the sides of the index fingers to run outward following the pattern 2-3-4-6-5.

**FIGURE-6****FIGURE-7**

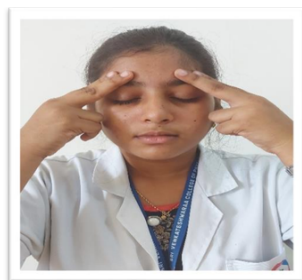


FIGURE-8

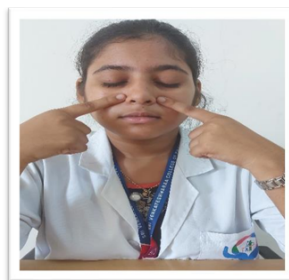


FIGURE-9

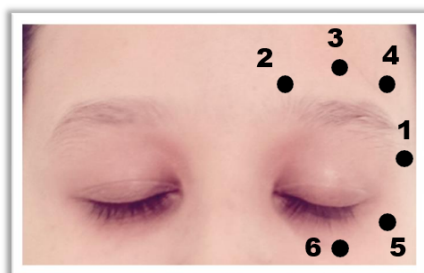


FIGURE-10

5) Flashing or blinking:

- Rest your eyes for few minutes by closing your eyes or by palming method.
- Then look at a fine print (i.e., a letter or a word at a distance where you are not able to read it).
- If you feel trouble to see that letter then again repeat the same process until you clearly see that letter or word.
- Gradually increase your distance based on your progression.



Figure 11:

6) Shifting:

- Extend your index finger in front of your face. Then move your head side to side with your eyes following your nose, but not stick your sight to your finger. Feel the movement of your index finger in the opposite direction to your head movement.
- Repeat this same process with your eyes closed and imagine the movement of your head and finger.



Figure 12 & 13:

7) Central fixation:

- Central fixation is seeing an object with center of vision.
- The center of vision is located between our eyes and at the level of our eyes. The center is the clearest area of the visual field which is clearer than 20/20.
- The exact center of the visual field is very small, about the size of the pointed end of a pin. This small area is the most perfect, clearest area of the visual field.
- Seeing with center of the visual field relaxes the mind and eyes. When the mind relaxes the eye relaxes and eyesight is clear.

**Figure 14:****8) Sun treatment/ Solarization:**

- Sunlight is necessary to get rest and relaxation.
- Expose the closed eye to the sunlight and move your head side to side for few minutes.
- Always do palming technique after doing the sun treatment.

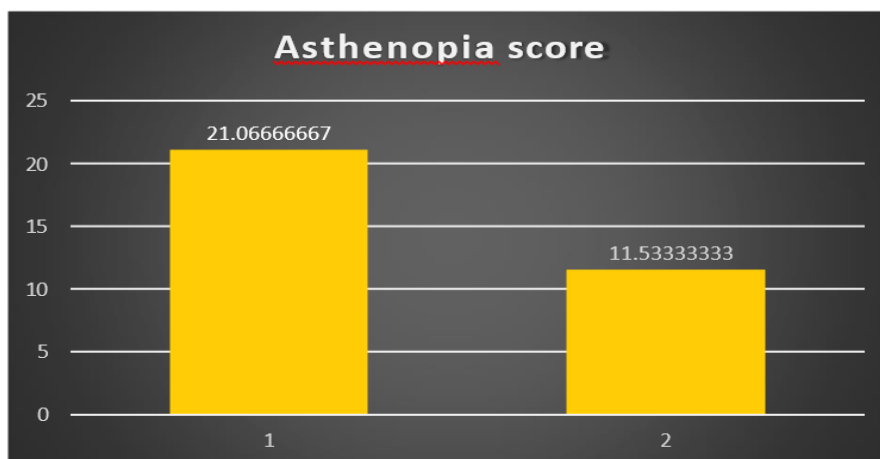
**Figure 15:****Statistical Analysis**

Showing the Pre and Post-Test Values of Asthenopia Questionnaire: Paired 'T' Test Values:

Table: 1

	Mean	Standard Deviation	T- Value	P-Value
Pre-Test	21.06667	8.979872	6.45	0.001
Post- Test	11.53333	5.040786		

The p value of asthenopia score is 0.001 which is considered as very significant. The t value is 6.45

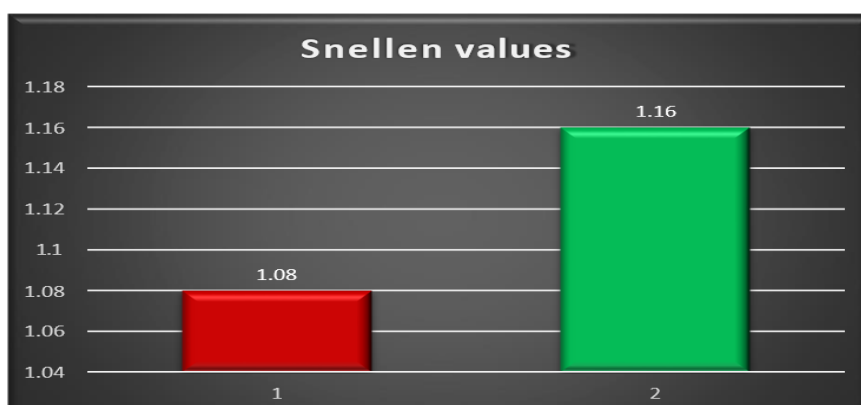
**Chart 1:**

Showing The Pre And Post-Test Values Of Snellen Chart: Paired 'T' Test Values:

Table 2:

	Mean	Standard Deviation	T- Value	P-Value
Pre-Test	1.08	0.32	2.86	0.01
Post-Test	1.16	0.28		

The p value of Snellen chart is 0.01 which is considered as significant. The t value is 2.86

**Chart 2:**

Showing The Pre And Post -Test Values Of Perceived Stress Scale Paired 'T' Test Values:

Table: 3

	Mean	Standard Deviation	T- Value	P-Value
Pre-Test	18.8	2.42604911	>0.05	1
Post-Test	18.13	11.74652938		

The p value perceived stress scale is 1 which is considered as not significant. The t value is 0.2 which is greater than 0.05

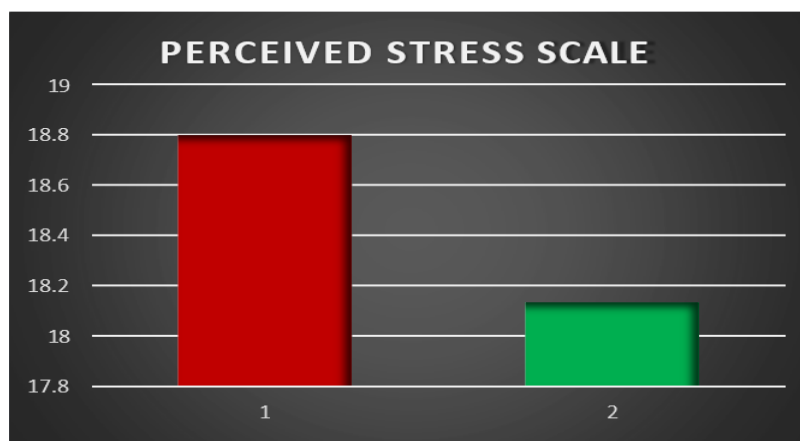


Chart 3:

Results

Paired T-Test For Asthenopia Questionnaire:

The pre and post-test values for t-test of asthenopia questionnaire is analyzed using paired t-test for 14 degree of freedom and at 5% of significance, the table value is 4.140 and the calculated t value is 6.45. Since the calculate t value is greater than the table t value null hypothesis is rejected. Hence, there is very significant effect of bates eye exercise in reducing visual fatigue.

Paired T-Test for Snellen chart:

The pre and post-test values for t-test of Snellen chart is analyzed using paired t test for 14 degree of freedom and 5% of significance, the table value is 2.624 and the calculated t value is 2.86. since the calculated t value is greater than the table t value null hypothesis is rejected. Hence, there is significant effect of bates eye exercise in reducing near induced transient myopia.

Paired T-Test For Perceived Stress Scale:

The pre and post-test values for t-test of perceived stress scale is analyzed using paired t-test for 14 degree of freedom and 5% of significance. Since the calculated value is

0.2 And p- value >0.05 indicates that the bates eye exercise has no significant effect in reducing the mental stress.

Discussion

According to a survey conducted by the Mobile Ecosystem Forum from November to December 2019, the highest penetration rate among smartphone users was in the age group of 16 to 24 years, with 37 percent. [18] So, there might be more chances for developing digital eye strain among this population.

In early 1900s, William Bates, an ophthalmologist wrote a book "Perfect sight without glasses" in that he said controversially that myopia is caused by a type of "eye strain" that was itself a result of "mental strain". [19] Stress can lead to eye strain [14,15] and

tensing the muscles around the eyes. Small screen and text of smartphone will demand more ocular work load which will leads visual fatigue. [12]

Aswitha et al., (2017) reported that the prevalence of cellphone vision syndrome/ eye strain is 44% and 83% had atleast any one symptoms of the eye strain those who used smartphone for atleast 2hrs per day with age group of 18-25 years. [10]

Sheedy et al., (2003) in his study described two set of symptoms for asthenopia. External symptoms such as burning, irritation, tearing and dryness were noted, while Internal symptoms such as strain, ache and headache behind the eyes were linked to accommodative and / binocular vision stress. [20]

Komal et al., (2018) checked the effects of vintage non-pharmacological techniques (Bates eye exercise Vs Trataka yoga kriya). Bates technique was given to one group for 8 weeks. They said that there was slight reduction in myopia. However, due to lack of evidential studies over this, Bates method is not yet proved to be effective. [21] In this study 20 samples were taken based on the selection criteria (n=20).

Convenient samplings were done and pre-test assessments were done using Snellen chart, perceived stress scale and asthenopia questionnaire. Post-test assessments were done only for 15 samples those who came for regular follow up. The result was concluded by taking paired t-test for the above-mentioned outcome tools.

Thus, the current study shows that there is significant reduction of visual fatigue and near induced transient myopia by using the Bates eye exercises. In this study, this exercise has some effects in reducing the mental strain. However, it has no statistical significance in reducing mental strain. The exact mechanism behind this was not understood. So, further researches are needed to reason out the things. This exercise may be effective if the exercise is continued for longer duration (i.e.,) more than 2 months.

Conclusion

This study is done to find out the effectiveness of bates eye exercise to reduce visual fatigue in smartphone using college students. Standard measurement tools were used to assess the effectiveness of the treatment. From this study it has been concluded that there is significant effect of bates eye exercise in reducing visual fatigue and near induced transient myopia in smartphone using college students. Hence the null hypothesis is rejected.

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