EFFECT OF CRANIAL BASE RELEASE TECHNIQUE ON REDUCING BLINKING RATE AMONG UNIVERSITY LEVEL STUDENTS WITH DIGITAL EYE STRAIN – AN EXPERIMENTAL STUDY

By

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In Partial Fulfilment
Of the requirements for the degree of

MASTER OF PHYSIOTHERAPY (MPT)
In
SPORTS

Under the Guidance of

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ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE BHUBANESWAR, ODISHA

2023-2025

Odisha University of Health Sciences, Bhubaneswar, Odisha

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation/thesis entitled **"Effect of cranial base release technique on reducing blinking rate among university level students with digital eye strain – An Experimental Study"** is a bonafide and genuine research work carried out by me under the guidance of Dr. Chinmaya Kumar Patra, Principal and Co- Guide Dr. Anand Kumar Sahoo (PT), Assistant Professor, Abhinav Bindra Sports Medicine and Research Institute, Bhubaneswar, Odisha, and there are no conflict of interest associated with this dissertation work.

Date: **Signature**

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Date : **Signature of the Co-Guide**

Place : **Dr. Anand Kumar Sahoo (PT)**

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Thank you.

Date: **Signature of the candidate**

Place: **Sumit Kumar Pati**

LIST OF ABBREVIATIONS USED

CBR – Cranial Base Release

CI – Confidence Interval

DES – Digital Eye Strain

MPT – Master of Physiotherapy

N – Sample Size

OUHS – Odisha University of Health Sciences

p-value – Probability Value

SD – Standard Deviation

SPSS – Statistical Package for the Social Sciences

ABSTRACT

Title:

EFFECT OF CRANIAL BASE RELEASE TECHNIQUE ON REDUCING BLINKING RATE AMONG UNIVERSITY LEVEL STUDENTS WITH DIGITAL EYE STRAIN – AN EXPERIMENTAL STUDY

Background: Digital Eye Strain (DES), also referred to as Computer Vision Syndrome, has become a significant public health concern among university students due to prolonged use of digital devices for academic and recreational purposes. Reduced spontaneous blink rate during screen exposure contributes to ocular surface instability and visual discomfort. Conventional management strategies often provide only temporary relief. Cranial Base Release (CBR), a gentle manual therapy technique, may influence neuromuscular and autonomic mechanisms related to blinking and thereby offer a novel intervention for DES.

Objective: The study aimed to evaluate the effect of Cranial Base Release on blink rate and Digital Eye Strain symptoms among university students.

Methods: A single-group pre–post experimental study was conducted with 25 university students aged 18–30 years who reported daily screen use of ≥4 hours and positive DES symptoms. Baseline data included demographics, average daily screen time, CVS-Q (Computer Vision Syndrome Questionnaire) scores, and spontaneous blink rate measured via video recording. Participants underwent CBR therapy four times per week for four consecutive weeks, totaling 16 sessions. Post-intervention assessment was conducted using the same tools and procedures. Data were analyzed using paired t-tests, with significance set at $p < 0.05$.

Results: Mean blink rate increased from 7.43 ± 0.85 blinks/min at baseline to 8.70 ± 1.03 blinks/min post-intervention, reflecting a significant improvement (mean difference = +1.26 ± 1.05; $t(24) = -6.00$, $p < 0.001$; Cohen's d = 1.20). CVS-Q scores decreased significantly from 8.96 ± 2.26 to 5.56 ± 1.78 (mean difference = −3.40 ± 2.00; $t(24) = 8.50$, $p < 0.001$; Cohen's d = 1.70). Both outcomes demonstrated large effect sizes.

Conclusion: The findings indicate that Cranial Base Release is effective in increasing spontaneous blink rate and reducing symptom burden of Digital Eye Strain among university students. As a non-invasive and drug-free intervention, CBR holds potential as an adjunct or alternative therapy for managing DES, particularly in populations with unavoidable high screen exposure.

Keywords: Blink Rate; Computer Vision Syndrome; Cranial Base Release; Digital Eye Strain, , Manual Therapy

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INTRODUCTION

INTRODUCTION

The twenty-first century has been known for widespread and almost ubiquitous use of technology in daily life. From education to professional work, entertainment to social relationships, the use of computers, smartphones, and tablets has become a fundamental part of how individuals live, learn, and interact. Digital devices are no longer supplemental tools; they are primary instruments that drive modern human activity. Over the past two decades, the proliferation of internet connectivity and mobile applications has accelerated this transformation, such that digital engagement has become nearly unavoidable. According to

recent global data, average daily screen time has reached unprecedented levels, particularly among young adults and students, who rely heavily on digital platforms for both academic and non-academic purposes (Statista, 2023). The rapid advancement of digital learning environments, especially after the COVID-19 pandemic, further accelerated the shift to online platforms, making extended digital exposure a core part of students' educational routines (Wong et al., 2021; Sheppard & Wolffsohn, 2018).

While the merits of digital technology in enlarging connection to education and improving global connectivity are unquestionable but growing concern have emerged regarding the physiological and psychological consequences of persistent screen exposures, particularly the condition now prevalent as Digital Eye Strain (DES), or Computer Vision Syndrome (CVS). University students constitute a population particularly vulnerable to the effect of prolonged digital screen use. Their academic commitments demand sustained engagement in online reading , virtual classes , digital research and the use of various platforms for assignments and collaborative work.

Beyond academic responsibilities , students frequently use digital devices for communication , entertainment and social media, which leading to even greater cumulative screen exposure. Studies have provided evidence that university students spend approx 8 to 12 hours per day using digital devices. which significantly surpassing the threshold at which occular discomfort and systemic strain are known to develop.(Bhanderi et al., 2021; Altalhi et al., 2022). Such continuous exposure is not only unavoidable but also increasingly normalized as part of higher education culture.

However, this normalization masks the growing public health issue associated with long-term consequences of screen use, namely the rise in symptoms linked to DES. It includes visual fatigue, eye dryness, blurred vision, headaches, and musculoskeletal discomfort associated with improper posture during digital engagement (Reddy et al., 2013; Coles-Brennan et al., 2019). The American Optometric Association identifies DES as a significant occupational and lifestyle-related visual condition, affecting both the eyes and the body (AOA, 2021). The visual system is thus compelled to exert additional accommodative and focusing effort, which accelerates fatigue (Rosenfield, 2016). Additionally, blue light emitted from digital devices has been shown to disrupt circadian rhythms and induce oxidative stress on retinal cells, raising further concerns about long-term consequences (Leung et al., 2017; Torun et al., 2023).

Environmental factors which put impacts are screen glare , inadequate lighting , improper viewing angle and reduced blink rate further exacerbate the ocular discomfort in the university students.

One of the most important but often overlooked aspects of Digital Eye Strain (DES) is its connection to changes in blinking patterns. Normally, people blink about 15 to 20 times a minute. This rate is essential for keeping the tear film stable, which is vital for eye comfort and clear vision. However, extended focus on digital screening significantly reduces the spontaneous blink rate , sometimes by over 50% which accelerates tear film evaporation and contributes to the onset of dry eye symptoms. (Tsubota & Nakamori, 1993; Uchino et al., 2013) Recent evidence provide information regarding the reduction of blinking frequency and the reduced blinking frequency plays a major role in onset and progression of DES. (Portello et al., 2012; Kaido et al., 2020). Students who engaged in prolonged screen based activities without sufficient blinking breaks and particularly vulnerable to discomfort and visual disturbances . over time this can contribute not only to ocular problem but also to systemic health issues such as sleep disruption , musculoskeletal pain and mental fatigue.(Ganne et al., 2021).

The prevalence of Digital Eye Strain (DES) among university students is notably high. Surveys in different countries show that 60% to 90% of students experience at least one symptom of DES, and many report multiple symptoms at the same time (Reddy et al., 2013; Altalhi et al., 2022). A large study during the COVID-19 pandemic found that over 80% of students faced significant eye discomfort. This was mainly due to the higher demands of online learning and virtual communication. (Mohan et al., 2021) These statistics show the scale of the problem and highlight the vulnerability of students as a group. Unlike office workers, students do not have proper ergonomic setups. They often spend long hours on laptops or smartphones in informal places like shared study spaces, which worsens the risk of DES (Coles-Brennan et al., 2019).

Moreover, the academic pressure of university life often forces students to keep using digital devices, even when they feel discomfort. This continues a harmful cycle of worsening symptoms. The effects of Digital Eye Strain (DES) reach well beyond temporary irritation. The visual and physical symptoms tied to this condition can greatly affect academic performance, mental health, and overall quality of life. Symptoms like blurred vision, headaches, and eye fatigue make it hard to focus and lower efficiency during learning. Additionally, pain in the neck and shoulders from poor posture while using screens adds to the physical strain. Emotional issues, such as irritability, anxiety, and social withdrawal, have also been connected to ongoing symptoms of DES. (Ganne et al., 2021; Sheppard & Wolffsohn, 2018).

From a public health perspective, the chronic nature of these symptoms raises serious concerns about the long-term viability of digital education models and their broader effects on student health and productivity. As global education shifts toward hybrid and online learning systems, addressing Digital Eye Strain (DES) has become a more urgent priority. Current management strategies for DES typically involve behavioral techniques, ergonomic adjustments, and pharmacological aids. Common recommendations include the 20-20-20 rule, which advises individuals to look at an object 20 feet away for 20 seconds every 20 minutes of screen use (Rosenfield, 2016). Artificial tears are often used to relieve dryness, while ergonomic interventions like adjusting screen height, seating posture, and lighting are encouraged to reduce strain. However, these strategies often provide only temporary relief. For example, artificial tears require frequent application and may cause irritation if they contain preservatives. Behavioral modifications also rely heavily on self discipline , which can be difficult for students to maintain consistently. (Coles-Brennan et al., 2019; Torun et al., 2023).

The gap between symptoms management and sustainabale relief highlights the need for more holistic approaches that address the root physiological mechanism of DES rather than merely its symptoms. In this context , mannual therapy intervention particularly those targeting the cranial base have gamered increasing attention.

Cranial Base Release (CBR) , a gentle mannual therapy technique derived from osteopathic and craniosacral practices , focuses on relieving tension in the sub-occipital region and cranial sutures , which may indirectly influence both visual and neurological function. Proponents of CBR suggest that restrictioin in this region can disrupt cranial nerve function , autonomic regulation and cerebrospinal fluid flow , factors potentially involved in blink regulation and ocular comfort.t (Cutler et al., 2005; Kostopoulos & Rizopoulos, 2008).

By enhancing parasympathetic activity and reducing musculoskeletal strain CBR may help restore normal blink freqency , thereby addressing one of the core physiological contribution to DES. Although direct empirical evidence remains limited , preliminary observations indicate that incorporating mannual therapy into DES management may offer a promising non - pharmacological complements to conventional treatments. (Chaitow, 2020).

Given the increasing prevalence of DES among university students and the limitations of current interventions, there is a compelling need to explore alternative treatments that target the condition’s physiological causes . Investigating the potential role of manual therapy particularly CBR technique offers an opportunity to expand the scope of therapeutic options for DES , bridging the field of ocular health and physical rehabilitation. Such exploration holds promise not only for enhancing student well-being and academic performance but also for contributing to the broader discourse on digital health and the sustainability of technology-driven

NEED FOR THE STUDY

Due to their extended reliance on computers, tablets, and cell phones for both academic and recreational purposes, university students are increasingly experiencing digital eye strain (DES). Prolonged screen time has an adverse effect on focus, output, and general health. Current therapeutic strategies including visual breaks, posture adjustment, and artificial tears provide short-term respite, but they largely treat symptoms rather than the underlying physiological changes, most notably the decrease in spontaneous blinking. This restriction makes it imperative to investigate alternate tactics that focus on the fundamental processes of DES. Blinking and tear film stability are intimately tied to autonomic balance, suboccipital muscle tension, and cranial nerve function, all of which have been proposed to be influenced by the Cranial Base Release Technique (CBR), a mild manual therapy. In the context of DES, CBR has not received enough attention, despite its promising result in previous studies

.Since, immediate effect of CBR is investigated on DES here, this study could be an adjunct to the evidence database for future reference in order to serve the university students better.

AIM AND OBJECTIVE

AIM OF THE STUDY

To find out the effectiveness of CBR technique on digital eye strain.

OBJECTIVES OF THE STUDY

1. To find out the effect of cranial base release technique on blinking rate.
2. To find out the effect of cranial base release technique on CVS-Q score.

HYPOTHESIS OF THE STUDY

HYPOTHESIS OF THE STUDY

Null Hypothesis:

1. There is no significant effect of the cranial base release technique on blinking test score among university level students.
2. There is no significant effect of the cranial base release technique on CVS-Q score among university students.

Alternate Hypothesis:

1. There is a significant effect of the cranial base release technique on blinking test score among university students.
2. There is a significant effect of the cranial base release technique on CVS-Q score among university students.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

1. Section A – to find the relation between the asthenopia and increased screen time.
2. Section B – to find the relation between the CBR and MSK system.
3. Section C – To find the test to assess asthenopia.

Section A – To find the relation between the asthenopia and increased screen time.

1. Kirandeep Kaur (2022)

The need for the study on Digital Eye Strain (DES) arises from the significant increase in the prevalence of this condition, The pandemic has led to a surge in the use of digital devices for work, education, and entertainment, resulting in a rapid rise in DES across all age groups. Digital eye strain (DES) has significantly increased since the with prevalence rates rising to 80-94%. The pandemic has led to a surge in screen time, contributing to DES and other health issues like myopia and musculoskeletal problems. Risk factors for DES include daily digital device usage of more than 4 hours, pre-existing refractive errors, and a history of dry eyes.

2. Das A, Shah S (2022)

The study was conducted to analyze the prevalence and factors of Computer Vision Syndrome (CVS), stress, and musculoskeletal issues among IT workers in Kathmandu valley, Nepal. CVS and musculoskeletal issues were prevalent among VDT screen users in Nepal, with factors like improper preventive measures and longer work hours contributing to CVS. Work-related stress was higher among those with shorter job tenure and spending more hours in front of a computer. The study highlights the importance of addressing these issues through interventions like proper work environment adjustments and breaks to reduce symptoms and improve overall well-being among IT workers.

3. **Mylona I, Deres ES, Dere GS Tsinopoulos I, Glynatsis M (2020)**

   The study addresses the need to understand the impact of internet and videogaming addiction on adolescent vision. It aims to highlight the negative effects of excessive screen time, such as Digital Eye Strain (DES). The study concludes that eye symptoms related to excessive screen time due to internet and gaming addiction are underreported in the literature. More research is needed to differentiate between different types of screen use and provide evidence-based guidelines for parents and users. While positive effects of playing videogames on vision have been extensively researched, a balanced approach considering the wider public health impact of gaming disorder is necessary.

4. **Coles-Brennan (2018)**

   Management of digital eye strain arises from the increasing prevalence of this condition in modern society, where the use of digital devices has become ubiquitous. The study underscores the multifaceted nature of digital eye strain and the need for a comprehensive approach that combines clinical management, ergonomic best practices, and public education to effectively combat this emerging public health issue.

5. **Sheppard AL, Wolffsohn JS (2018)**

   Digital Eye Strain (DES), Prevalence and Impact of Digital Eye Strain. Usage of digital devices is widespread, leading to normal extended daily use among all age groups. The field of DES research continues to evolve, highlighting the importance of staying updated on emerging evidence.

Section B – to find the relation between the CBR and MSK system.

1. **Morten Carstens Moe, Emin Ozmert et all. (2023)**

   The need for the study on sports-related ophthalmology arises from the critical role of vision in athletic performance, as nearly 80% of perceptual input in sports is visual. The study emphasizes the importance of collaboration between sports medicine professionals and ophthalmologists to provide proper eye care and preventive strategies. It aims to establish a unified, evidence-informed approach to ophthalmic health management in elite sports, ultimately enhancing athlete safety and performance. The conclusion of the study emphasizes the necessity for sports medicine physicians to be well-versed in assessing eye injuries and determining appropriate management strategies for athletes. The study advocates for interdisciplinary collaboration between sports medicine and ophthalmology to ensure athletes receive comprehensive care, ultimately safeguarding their health and enhancing their performance in sports.

2. Prabu raja (2021)

The need for the study on the anatomical myofascial continuum between the neck and eyes is to address the lack of consensus regarding the anatomical connections between the head, neck, and eyes, as well as the functional interrelationships among these structures. Neck pain is usually associated with many symptoms including temporomandibular pain, oculomotor dysfunctions, and headache, indicating a possible functional interrelationship between these structures. Understanding this structural myofascial link and the possible functional interrelationships between the eyes, head, and neck will help medical professionals to diagnose and treat painful conditions of the head and neck using fascia-directed evaluation and treatment approaches.

3. Chandra, P. R., Biswajit, K., & Manpreet, K. (2019)

To find the efficacy of the Cranial Base Release (CBR) technique on postural instability in patients with Cervicogenic Headache (CGH), The study concluded that the CBR technique could be an effective part of the treatment protocol for managing patients with Cervicogenic Headache due to the significant improvement in postural instability observed in all patients.

Section C – To find the test to assess asthenopia.

1. **Cantó-Sancho M. (2022)**

   The study aimed to validate the Italian version of the Computer Vision Syndrome Questionnaire (CVS-Q IT©)

   The Rasch-Validated Italian Scale for Diagnosing Digital Eye Strain, specifically the Computer Vision Syndrome Questionnaire IT©, provides a validated and reliable tool for assessing digital eye strain in Italian workers. By validating the psychometric properties of the Italian version of the questionnaire, this study contributes to the accurate diagnosis and evaluation of computer vision syndrome in the Italian population, addressing the need for standardized and validated instruments in this field.

2. **Tsovinar Harutyunyan et al., (2020)**

   This study is crucial for addressing the growing concern of CVS among university students and for promoting eye health and well-being in academic settings.

   The study on Computer Vision Syndrome (CVS) among students at the American University of Armenia was essential for understanding the prevalence, risk factors, and awareness of CVS among that specific population. It aimed to provide insights for developing preventive measures and interventions to promote eye health and well-being among university students in the digital age. The study concluded that the intervention technique had a significant impact on improving the outcome in the participants

3. **Sheppard AL, Wolffsohn JS (2018)**

   To find the importance of Blinking in a healthy ocular surface, which may contribute to dry eye symptoms often associated with DES. Blinking is essential for maintaining a healthy ocular surface, as it helps distribute tears and prevents dryness. However, studies have shown that blink rate can significantly decrease during computer use, which may contribute to dry eye symptoms often associated with DES.

4. **Gowrisankaran S, Sheedy JE, Hayes JR (2017)**

The study was conducted to investigate the impact of voluntary eyelid squint on blink_activity and electromyography measures from the orbicularis oculi muscle. The primary aim was to determine if eyelid squint could inhibit blink rate. Voluntary eyelid squint was found to significantly reduce blink rate by 50% or more, depending on the level of squint attempted. The study highlighted that all tested levels of voluntary squint resulted in distinct EMG signals from the orbicularis muscle compared to the resting state, indicating the potential use of EMG as a reliable indicator of eyelid squint.

MATERIALS AND METHODOLOGY

MATERIALS AND METHODOLOGY

1 **STUDY POPULATION:** University level students

2 **STUDY DESIGN:** Experimental study

3 **SAMPLING TECHNIQUE:** Convenient sampling

4 **SAMPLE CRITERIA:**

INCLUSION CRITERIA:

1. Screen time: >4 hours /day (for more than 4 weeks)
2. Age: 18-36 years both Male and female
3. Digital eye strain – less than 15 blinks/min
4. Moderate myopia – not more than -6.0 D

EXCLUSION CRITERIA:

1. Pre-existing eye conditions (e.g., glaucoma, severe myopia) or recent eye surgery within 6 months.
2. Any kind of ongoing medication related to eye.
3. Skin allergies over suboccipital region.
4. Traumatic eye injury and blindness.

5 **STUDY SETTING:** ABSMARI, Odisha

6 **SAMPLE SIZE:** 25

7 **STUDY DURATION:** 1 year

- **Ethical clearance:** 6 months
- **Sample selection, data collection:** 4 months
- **Statistical analysis, results analysis, discussion:** 2 months

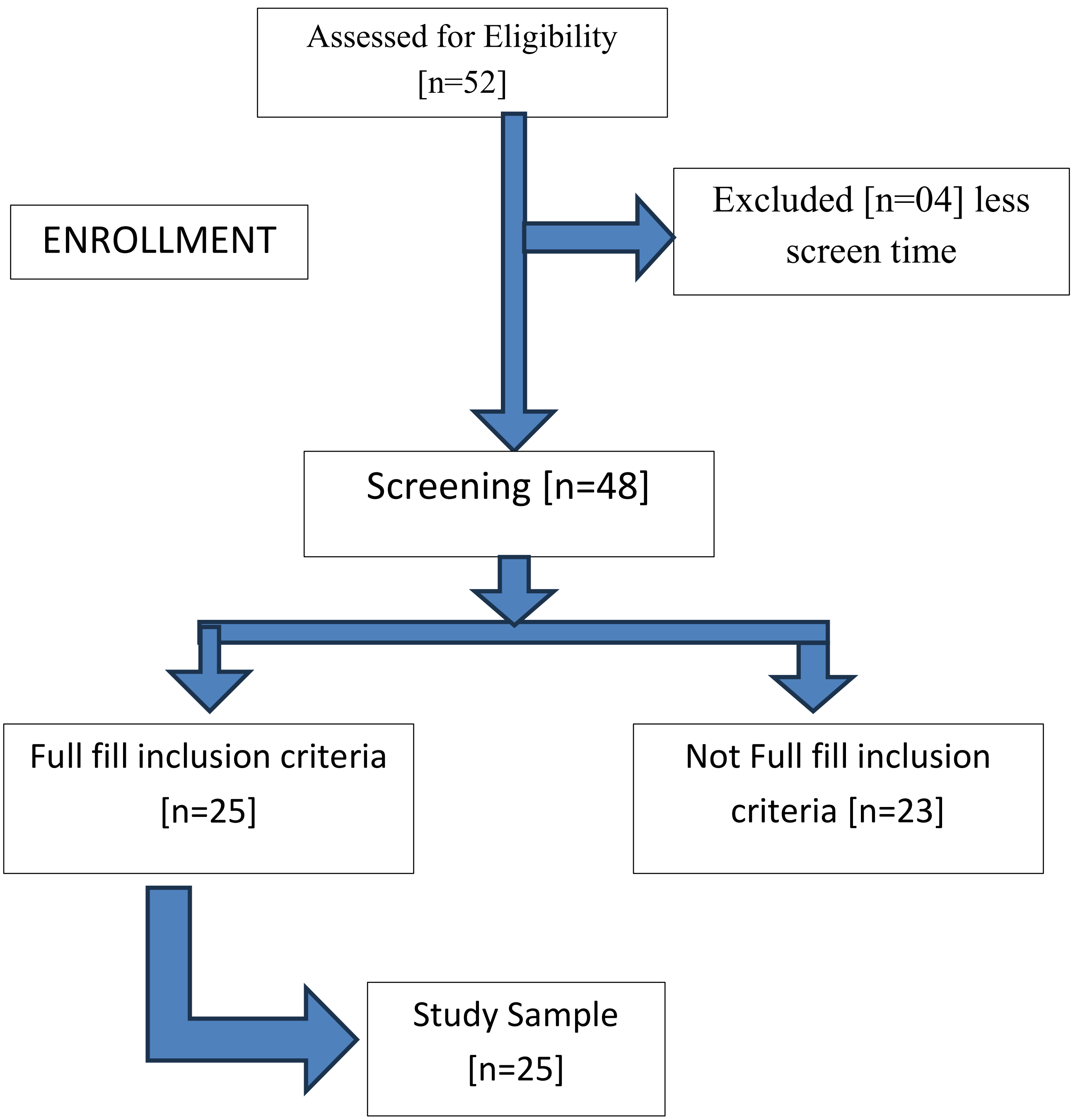
➢ **MATERIALS REQUIRED:**

1. Camera
2. Digital screen (Laptop, Tablet, Mobile etc)
3. Tripod
4. CVS Q Questionnaire

- **OUTCOME MEASURES**

1. Blinking test
    1. Test retest – (0.80 - 0.95)
    2. Interobserver Reliability - (0.80 - 0.90)
2. Computer Vision Syndrome – Questionnaire
    1. Cronbach's alpha – 0.92
    2. ICC – 0.802

FLOW CHART


Assessed for Eligibility [n=52]
ENROLLMENT
Excluded [n=04] less screen time
Screening [n=48]
Full fill inclusion criteria [n=25]
Not Full fill inclusion criteria [n=23]
Study Sample [n=25]

PROCEDURE

PROCEDURE

Approval from IEC

↓

Recruitment of University level Students

↓

Screening for Eligibility Criteria

(Age 18–36, ≥4 hrs/day screen time, DES symptoms)

↓

Informed Consent and Enrollment

↓

Baseline (Pre) Assessment (Week 0)

- Demographic data, daily screen time

- Computer Vision Syndrome Questionnaire (CVS-Q)

- Blink rate measurement (video recording)

↓

Intervention Phase: Cranial Base Release

4 Sessions per week × 4 Weeks = 16 sessions

↓

Post-intervention Assessment (Week 4)

- Daily screen time diary (final week)

- Computer Vision Syndrome Questionnaire (CVS-Q)

-Blink rate measurement (video recording)

↓

Data Processing

- Blink count

- Data entry and statistical analysis (Paired t-test)

↓

Final Results

- Change in blink rate (blinks/min)

- Change in CVS-Q scores

- Change in average daily screen time

This study has a single-group pre–post design to investigate the effect of Cranial Base Release (CBR) therapy on spontaneous blink rate and Digital Eye Strain (DES) symptoms in university students. Participants were recruited within the campus setting and screened using predefined criteria, Students between 18 and 36 years of age, with a daily screen exposure of at least four hours and positive DES symptoms, were considered eligible. Exclusion criteria included recent ocular surgery, neurological conditions influencing blinking, active ophthalmic treatment, or any contraindications for manual cranial therapy. After screening, written informed consent was obtained before enrollment.

Baseline evaluation was carried out during the initial visit. Demographic information was collected, and daily screen usage was documented through a self-reported diary, verified against digital usage logs wherever possible. Symptom burden was assessed using CVS-Q. The physiological outcome of blink rate was recorded by means of high-resolution video monitoring while participants viewed a neutral six-minute visual stimulus on a screen at a fixed distance. Only minutes two through five of the recording were analyzed to avoid artifacts at the beginning and end. Intervention phase last for 4 consecutive weeks and four CBR sessions/week, totaling sixteen sessions. Each treatment session lasted approximately 20 minutes and was administered by a trained physiotherapist using a standardized protocol focused on the cranial base and suboccipital regions. All participants were observed for any discomfort or adverse responses throughout the program.

Post-intervention assessment was conducted within two to three days after the final session, following the same protocol as baseline. Screen time from the final week was recorded, CVS-Q was re-administered, and blink rate was again measured under identical conditions. Video files were anonymized and coded by independent assessors blinded to session timing, ensuring unbiased outcome evaluation. Inter-rater reliability for blink counts was calculated, and discrepancies were resolved by consensus. Pre- and post data securely stored and analyzed statistically. Paired-sample t-tests were applied to compare baseline and post-intervention values for blink rate, CVS-Q scores, and daily screen exposure. This structured approach provided a reliable framework to evaluate the role of CBR in modulating blinking behavior and alleviating DES symptoms among university students.

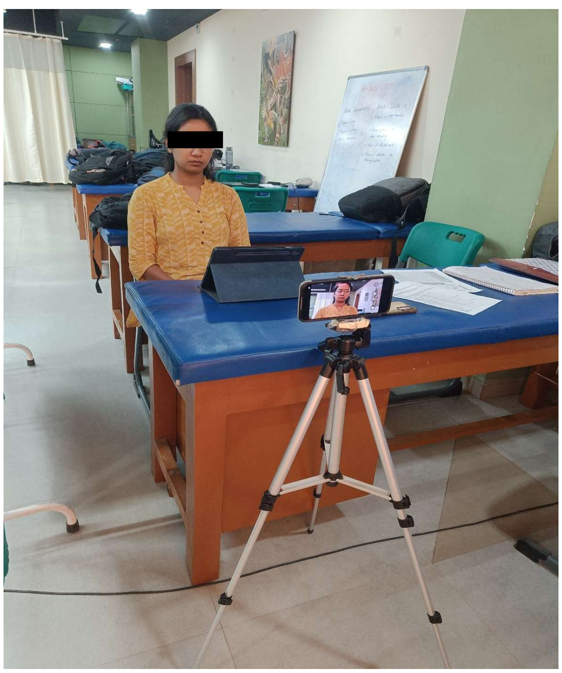


Figure 1

Figure 2

STATISTICAL ANALYSIS AND RESULTS

STATISTICAL ANALYSIS

The statistical analysis was performed using SPSS statistical package for social sciences version 22. Level of significance was set at $p < 0.05$. The normality of data was calculated using Shapiro Wilk test. Descriptive statistics was done to assess the mean and standard deviation of the specific groups. The inferential statistics that is the Paired t-test was used for analysis within the group analysis.

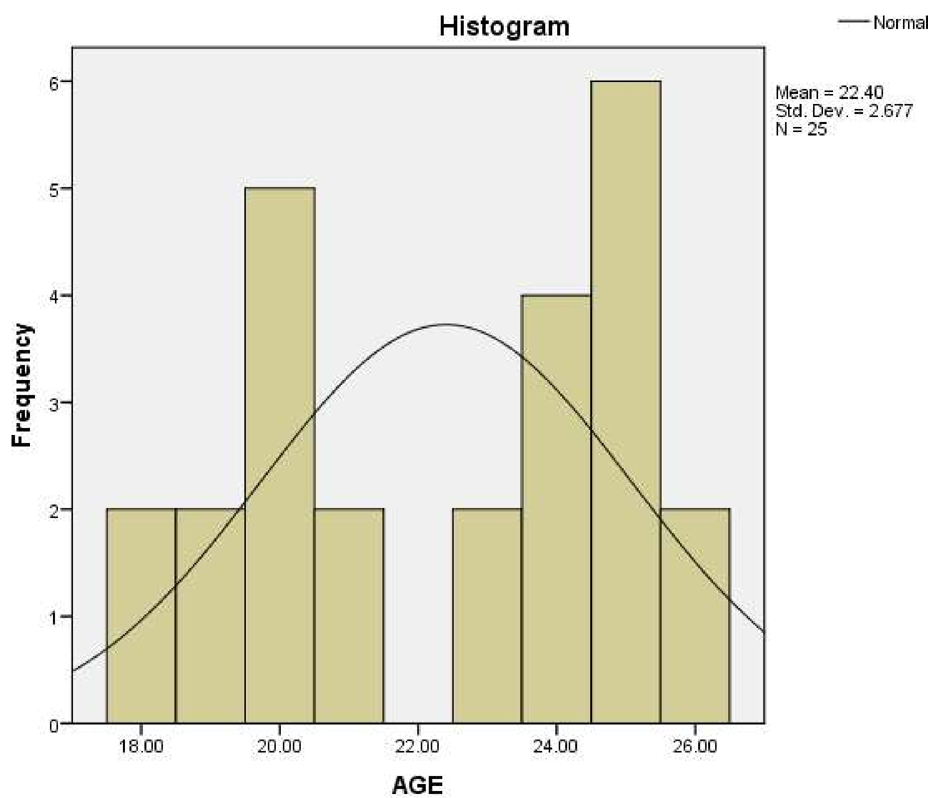
RESULTS AND INTERPRETATION

A total of 25 university level students (mean age = 22.40 ± 2.68 years) completed the study. The interpretation of descriptive statistics primary outcome of blink rate showed a significant increase after the 4-week intervention with CBR technique. At baseline, the mean blink rate was 7.43 ± 0.85 blinks/min, which increased to 8.70 ± 1.03 blinks/min following the intervention. The mean change was +1.26 ± 1.05 blinks/min.

Table 1: TEST OF NORMALITY

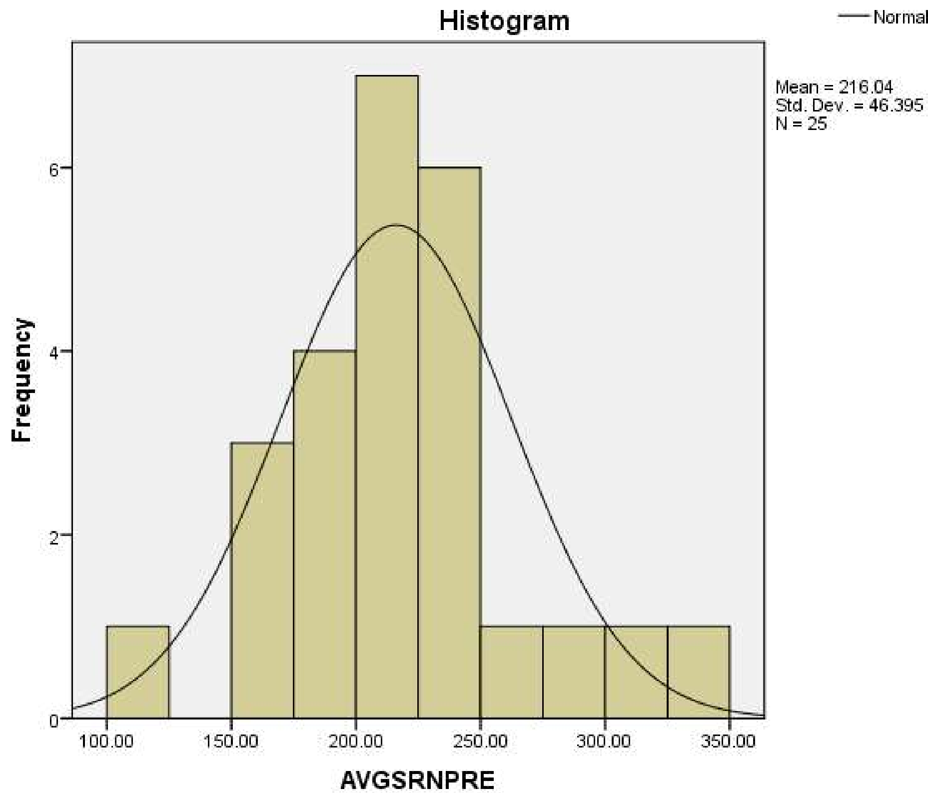
VARIABLES	EG(N=25)	P-value
	Mean ± SD	
Age (in years)	22.4±2.68	0.009
Blink rate	7.43±0.84	0.193
CVS	8.96±2.26	0.081
Average screen time	216.04±46.39	0.343

All the three variables i.e. blink rate, CVS, Average screen time are normally distributed as, p> 0.05, while Age is not normally distributed as p <0.05.



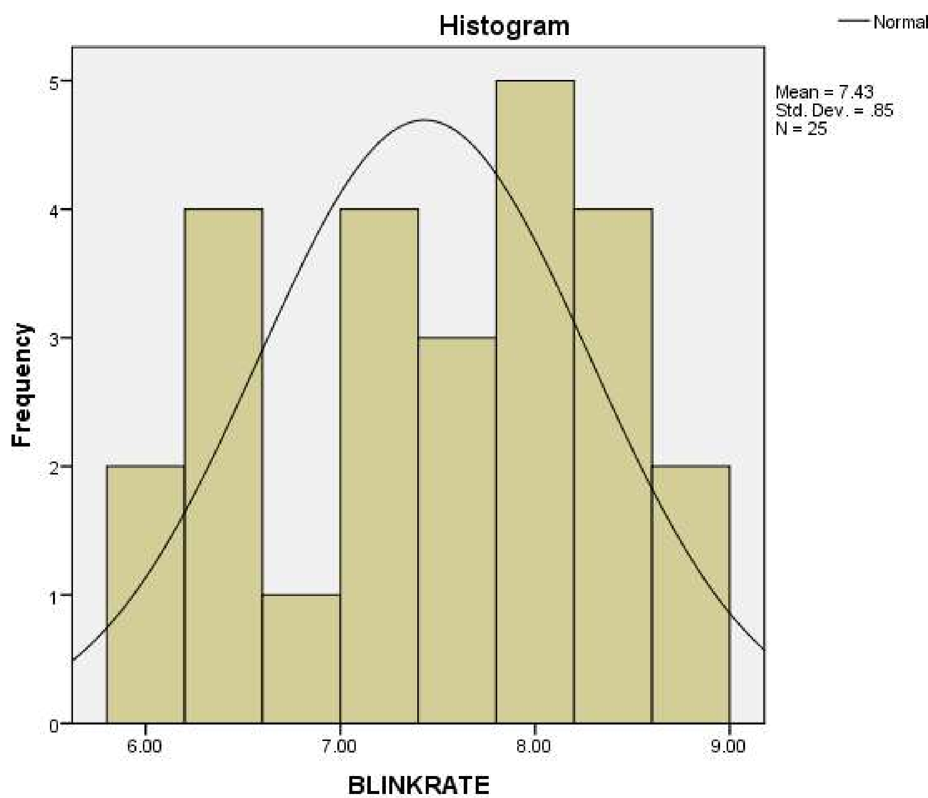
Graph-1

Normality plot of Age ,which is not normally distributed.



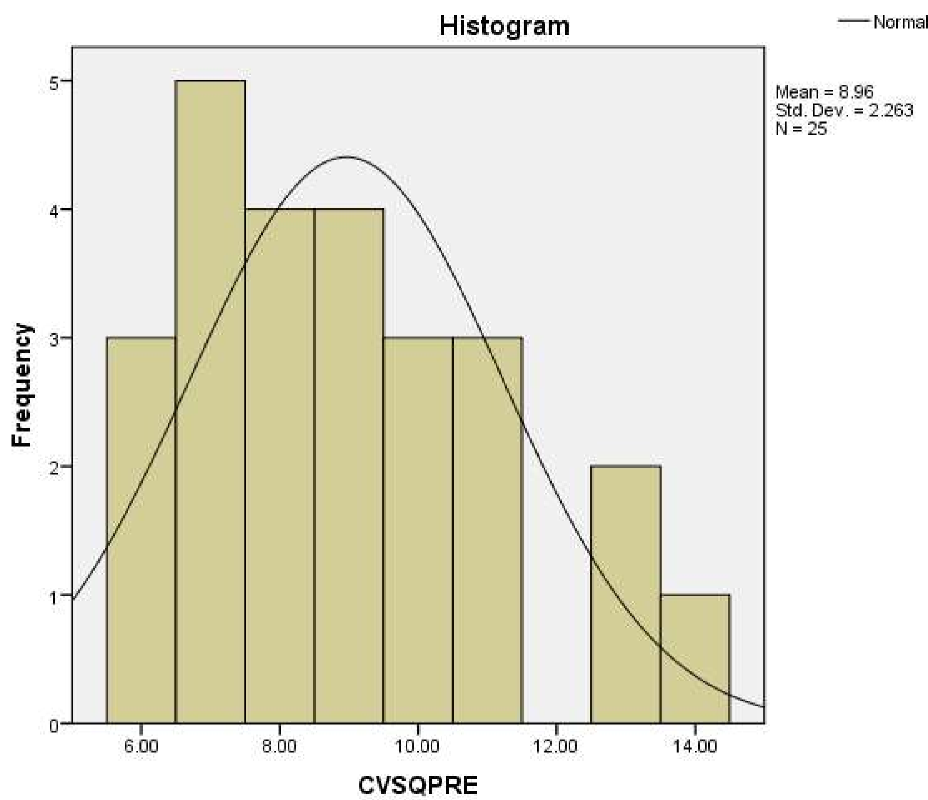
Graph-2

Normality plot of avg. screen time which is bell shaped.



Graph-3

Normality plot of blink rate.



Graph-4 Normality plot of CVSQ.

TABLE 2: WITHIN GROUP COMPARISON OF PRE- AND POST-INTERVENTION SCORES

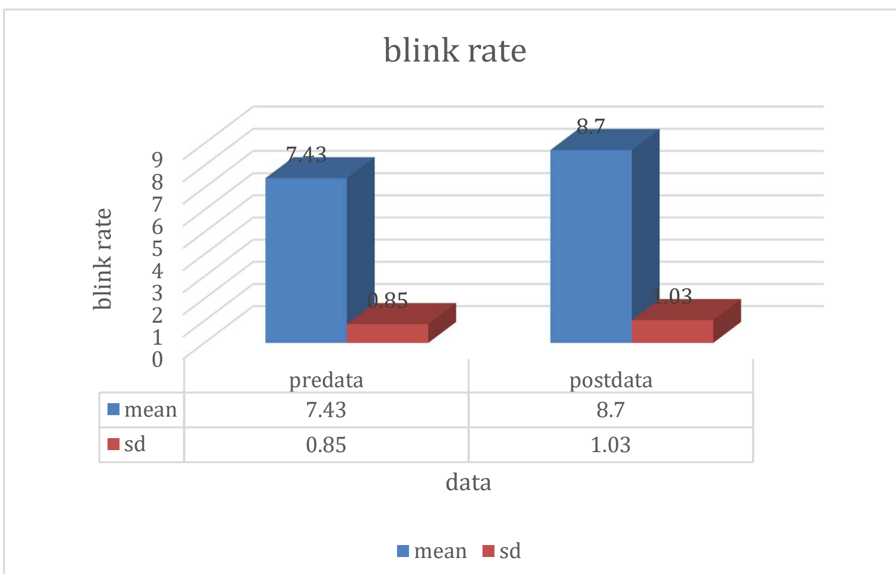
VARIABLES	Pre data Mean± SD	Post data Mean± SD	p-value	r
Blink rate	7.43±0.85	8.70±1.03	0.05	0.389
CVS	8.96±2.26	5.56±1.78	0.006	0.533

Table 3: Comparison of mean change of scores

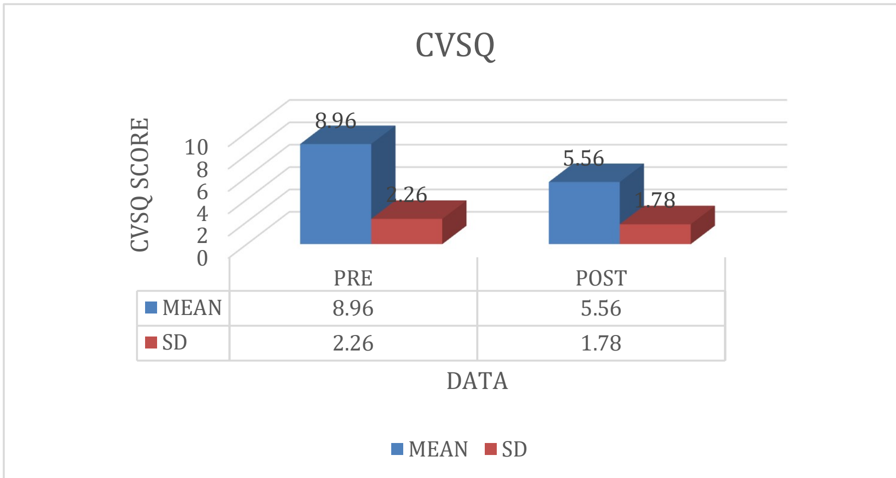
VARIABLES	Mean change (Mean± SD)	t	p-value	Effect Size (Cohen's d)
Blink rate pre-blink rate post	-1.26±1.05	-6.001	0.000	1.20
CVSQ pre-CVSQ post	3.4±2.0	8.50	0.000	1.70

A paired-samples t-test confirmed that this increase was statistically significant, t (24) = −6.00, $p < 0.001$, with a 95% CI [0.83, 1.70]. The effect size was Cohen's d = 1.20, indicating a large clinical effect. The correlation between pre- and post-intervention blink rates was moderate (r = 0.389, p = 0.05).

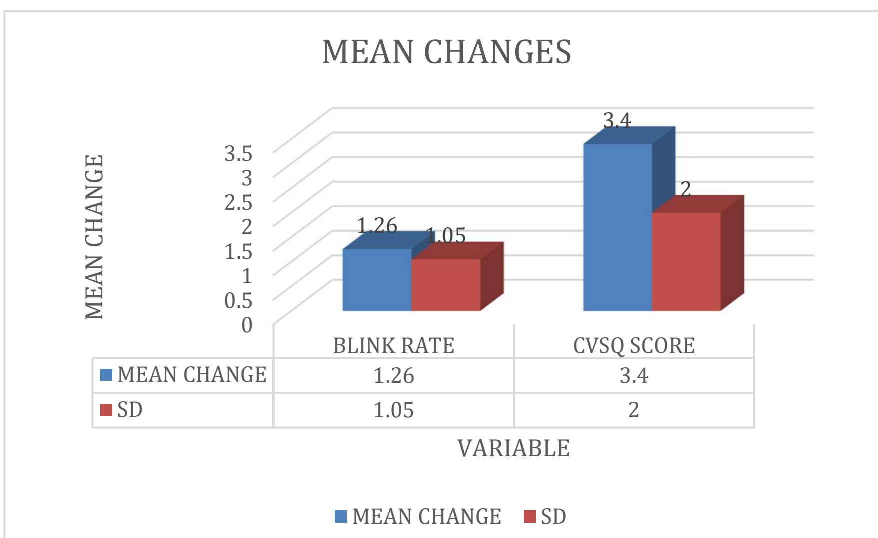
For the secondary outcome, the Computer Vision Syndrome Questionnaire (CVS-Q) total score showed a significant reduction. The mean pre-intervention CVS-Q score was 8.96 ± 2.26, which decreased to 5.56 ± 1.78 after the 4-week intervention with CBR technique. The mean reduction was −3.40 ± 2.00 points. This change was statistically significant, t(24) = 8.50, p < 0.001, with a 95% CI [2.57, 4.23], and a very large effect size (Cohen's d = 1.70). The correlation between pre- and post-CVS-Q scores was also significant and moderate (r = 0.533, p = 0.006).



Graph-5



Graph-6



Graph-7

DISCUSSION

DISCUSSION

The present study investigated the effect of a four-week Cranial Base Release (CBR) intervention on spontaneous blink rate and Digital Eye Strain (DES) symptoms among university students. Findings revealed a statistically significant increase in spontaneous blink rate following the intervention, accompanied by a marked reduction in CVS-Q scores. Both changes were associated with large effect sizes, highlighting the potential role of CBR as a non-pharmacological therapeutic strategy for alleviating ocular discomfort related to prolonged screen exposure. The observed increased blink rate in this study is particularly important, as reduced blinking during sustained digital screen use is recognized as a central factor contributing to tear film instability and ocular discomfort. Previously done research has consistently shown that normal blink frequency ranges between 15 and 20 blinks per minute under natural conditions, yet this rate decreases substantially during prolonged screen exposure, often dropping below 10 blinks per minute (Sheppard & Wolffsohn, 2018; Cardona et al., 2011). The baseline values recorded in the current study (7.43 blinks/min) have been supported with this evidence, confirming that participants experienced blink suppression linked to digital screen use. The significant post-intervention improvement (8.70 blinks/min) suggests that CBR may positively influence neuromuscular or autonomic processes which regulate spontaneous blinking. The CVS-Q which measures. Symptom reduction, also aligns with previous reports that link improved blink efficiency to reduced ocular strain and dryness. Previous studies have demonstrated that interventions aimed at restoring blink rhythm, such as blinking exercises or ergonomic adjustments, can yield symptomatic relief (Rosenfield, 2016; Coles-Brennan et al., 2019). Adherence to behavioral modifications, however, is often limited in student populations due to academic demands and prolonged exposure to digital platforms. The current study extends these findings by showing that a manual therapy approach, such as CBR, may provide symptom relief without requiring extensive behavioral change, thereby offering a feasible alternative or adjunct to conventional strategies. The mechanisms underlying the observed improvements may be multifactorial. CBR is designed to release myofascial and cranial base restrictions, precisey in the suboccipital and sphenoid regions, that are closely associated with cranial nerves influencing ocular and autonomic function. It has been proposed that manual cranial techniques can modulate parasympathetic activity, reduce sympathetic overdrive, and enhance cerebrospinal fluid dynamics (Cutler et al., 2005). This shift in autonomic balance may contribute to improved tear secretion and blink regulation. Additionally, muscle relaxation in the cranial base region may alleviate referred pain around the orbital complex, indirectly reducing ocular strain. Although these mechanisms remain speculative, the large effect sizes observed in both blink rate and CVS-Q score lend support to the hypothesis that cranial-based manual therapy can influence physiological processes relevant to DES.

Another key outcome was the consistency of effect across participants, with relatively narrow confidence intervals indicating robust improvements in both physiological and subjective measures. This finding is clinically relevant, as it suggests that the benefits of CBR were not limited to a small subgroup but rather generalized across the student sample. Such results are particularly valuable in a university setting, where prolonged exposure to digital screens is virtually unavoidable due to academic and social requirements.Despite promising results, several limitations must be acknowledged. First, the study utilized a single-group pre–post design, which restricts the ability of casual inferences. The absence of a control group means that improvements could partially reflect placebo effects, increased awareness of blinking, or natural variability over time. Second, the study period was limited to four weeks, and it remains uncertain whether the observed benefits persist beyond the intervention phase. Longitudinal follow-up studies are therefore necessary to determine the durability of CBR effects. Third, the sample size, while sufficient to detect statistical significance, was relatively small and drawn from a single university population, which may limit generalizability to broader student or occupational groups.

Larger, multi-center trials are also recommended to strengthen external validity and explore the scalability of CBR as part of routine management for DES in academic and workplace environments.

CONCLUSION

CONCLUSION

The study examined the effect of the Cranial Base Release (CBR) technique on blinking test and CVS-Q scores in university students with Digital Eye Strain. After four weeks of CBR treatment, both scores improved significantly, with increased blink rate and reduced eye strain symptoms. The results led to the rejection of the null hypothesis, confirming that CBR effectively enhanced blink behavior and alleviated symptoms. The study highlighted the clinical value of CBR as a safe, non-invasive method to improve eye health in populations with high screen use, and recommended further research with larger samples to explore long-term effects.

LIMITATION

AND

SCOPE FOR FUTURE STUDIES

LIMITATION

1. The study used a single-group pre–post design without a control group.
2. The sample size was small (n = 25) and limited to one institution, reducing generalizability.
3. The four-week duration only assessed short-term effects; long-term outcomes remain unknown.
4. Screen time and symptoms were self-reported, which may introduce recall bias or errors.

SCOPE FOR FUTURE STUDIES

Future research should focus on conducting randomized controlled trials to compare Cranial Base Release (CBR) with common treatments like artificial tears, ergonomic changes, blinking exercises, to better understand its true effects.

Studies with more number of sample size and diversity across different universities, workplaces, and age ranges should take place. Follow up after treatment to check if the benefits of CBR last and whether booster sessions are needed.

Exploring different session lengths and frequencies could help diagnose the most effective treatment plan. Combining CBR with other non-medical approaches like better posture or screen filters.

SUMMARY

SUMMARY

This study examined the effects of the Cranial Base Release (CBR) technique on university students' digital eye strain (DES). For four weeks, 25 students who reported having DES participated in CBR sessions. The Computer Vision Syndrome Questionnaire (CVS-Q) was used to measure their blink rate and gauge how severe their eye strain symptoms.

Following the four weeks, the participants' performance improved noticeably. Their CVS-Q scores decreased and their blink frequency increased, indicating less eye strain and discomfort. These findings suggest that CBR will aid in enhancing eye function and mitigating the symptoms of digital eye strain.

For students and those who spend a lot of time in front of a computer, CBR seems is safe, secure and non-intrusive, and is useful way to manage DES. Some of the drawbacks are limited sample size, no control group, and a brief follow-up period To verify the long-term advantages of CBR, more research is required which includes larger and more diversed groups, longer follow-ups, and comparisons to conventional therapies.

CONFLICT OF INTEREST

AND

FUNDING

CONFLICT OF INTEREST STATEMENT

No potential conflict of interest was reported by the author. The author alone is responsible for the content and writing of this thesis.

FUNDING

The author reported that no funding was associated from outside sources the work featured in this thesis. The author declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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ANNEXURES

ANNEXURE 1

INFORMED CONSENT FORM

APPENDIX-X

INFORMED CONSENT

Study Title: Effect of Cranial base release (CBR) on blinking rate among university students with digital eye strain - An experimental study.

Study Number: ___

Subject 's Name: ________________________________

Date of Birth / Age:
Address of the Subject
Qualification
Occupation

I. I confirm that I have read and understood the information sheet dated _________for the above study and have had the opportunity to ask questions.
II. I understand that my participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.
III. I understand that the Sponsor of the clinical trial, others working on the Sponsor 's behalf, the Ethics Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published.
IV. I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s).
V. I agree to take part in the above study.

Signature (or Thumb impression) of the Subject/Legally Acceptable Representative:

Date: / /

Signatory 's Name:

Signature of the Investigator:

Date: / /

Study Investigator 's Name: Sumit Kumar Pati

ANNEXURE 2

ETHICAL COMMITTEE CLEARANCE CERTIFICATE

ABSMARI ETHICS COMMITTEE

ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE,
BHUBANESWAR, ODISHA

CDSCO Reg. No.: ECR/1981/Inst/OD/24

Prof. (Dr.) E. Venkata Rao
Chairperson

Mr. Chinmaya Kumar Patra
Member Secretary

Ref. No. ABSMARI/IEC/2025/164

Date: 09/05/2025

MEMBERS

Dr. Smaraki Mohanty
Clinician

Dr. Satyajit Mohanty
Scientific Member

Mr. Shib Shankar Mohanty
Legal Expert

Ms. Annie Hans
Social Scientist

Ms. Subhashree Samal
Lay Person

Mr. Deepak Ku. Pradhan
Scientific Member

IEC-SECRETARIAT

Mr. Gouranga Ku. Padhy
Mr. Susant Ku. Raychudamani

S.N.	Name of the Member	Designation & Qualification	Representation as per NDCT 2019	Gender (M/F)	Affiliation with the Institution (Y/N)
1	Prof. Dr. E. Venkata Rao	Professor (MBBS, MD, Dept. of Community Med.) IMS & Sum Hospital, BBSR	Chair Person	M	N
2	Dr. Smaraki Mohanty	Asst. Prof-IMS & Sum Hospital/MBBS, MD (Community Med)	Clinician	F	N
3	Mr. Chinmaya Kumar Patra	Principal-ABSMARI, MPT	Member Secretary	M	Y
4	Ms. Annie Hans	Disability Inclusive Development Co-Ordinator in Humanity and Inclusion (India/Nepal/Srilanka). /MA in Social Work	Social Scientist	F	N
5	Ms. Subhashree Samal	Ret. Reader-Pol Sc.	Lay Person	F	N
6	Mr. Deepak Kumar Pradhan	Asst. Prof-ABSMARI, MPT	Scientific Member	M	Y

This is to confirm that only members who are independent of the Investigator and the Sponsor of the trial have voted/ provided opinion on the trial.

This Committee approves the documents and the conduct for the study in the presented form with necessary recommendation.

The ABSMARI IEC must be informed about the progress of the study in the prescribed format attached, any SAE occurring in the course of the study, any changes in the protocol and patient information/informed consent/assent and request to provide a copy of the final report.

The ABSMARI IEC follows procedures that are in compliance with the requirements of ICH (International Conference on Harmonization) guidance related to GCP (Good Clinical Practice) and applicable Indian regulations.

Yours sincerely,

9.5.25

Mr. Chinmaya Kumar Patra
Member Secretary
ABSMARI Ethics Committee
Pahal, Bhubaneswar

Member Secretary
ABSMARI ETHICS COMMITTEE

ETHICS COMMITTEE ABSMARI BHUBANESWAR Dt. 9/5/25

2

Utkal Signature, Plot No.-273, Ground Floor, Pahal, Bhubaneswar-752101 +91-63707-03654 iec@absmari.com

ANNEXURE 3

ASSESSMENT FORM

ASSESMENT FORM

DEMOGRAPHIC DATA:

- **Name**: ________________________________
- **Age**: __________________________________
- **Gender**: _______________________________
- **Occupation**: ___________________________
- **Date of Assessment**: ____________________
- **Qualification:** _________________________
- **Height (in cms):** _______ Weight (in kgs): _______
- **Past Medical & Surgical History**

  (A) Medical History
  - **Any medical history? (Yes/No, specify)**

  (B) Surgical History
  - **Any surgeries in the past? (Yes/No, specify)**

  ____

- **Contact details:**
  - **Phone no.:**
  - **Email:**
  - **Address:**
- **Parameters for digital eye strain**
  - **Avg Screen time (pre)_____________ (post)______________**
  - **Blink rate per min (pre)______________ (post)______________**
  - **CVS-Q score (pre) _____________ (post)______________**
- **Protocol to be given: Cranial base release for 20 mins per session**
  Frequency: 4 days/week.

ANNEXURE 4

COMPUTER VISION SYNDROME – QUESTIONARE

CVS-Q

COMPUTER VISION SYNDROME QUESTIONNAIRE

To be completed by worker

Indicate whether you experience any of the following symptoms* during the time you use the computer at work. For each symptom, mark with an X:

a. First, the frecuency, that is, how often the symptoms occurs, considering that:
   NEVER = the symptom does not occur at all
   OCCASIONALLY = sporadic episodes or once a week
   OFTEN OR ALWAYS = 2 or 3 times a week or almost every day

b. Second, the intensity of the symptom:
   Remember: If you indicated NEVER for frequency, you should not mark anything for intensity.

* *If you regularly wear glasses or contact lenses when working with digital devices, you should answer by thinking about how you feel when you wear them*

	a. Frecuency			b. Intensity	
	NEVER	OCCASIONALLY	OFTEN OR ALWAYS	MODERATE	INTENSE
1. Burning					
2. Itching					
3. Feeling of a foreign body					
4. Tearing					
5. Excessive blinking					
6. Eye redness					
7. Eye pain					
8. Heavy eyelids					
9. Dryness					
10. Blurred vision					
11. Double vision					
12. Difficulty focusing for near vision					
13. Increased sensitivity to light					
14. Coloured halos around objects					
15. Feeling that sight is worsening					
16. Headache					

To be completed by investigator

Calculation of TOTAL SCORE, considering that:

- Frequency:
  - NEVER = 0
  - OCCASIONALLY = 1
  - OFTEN OR ALWAYS = 2
- Severity:
  - The result of Frequency x Intensity should be recorded as: 0 = 0; 1 or 2 = 1; 4 = 2
- Intensity:
  - MODERATE = 1
  - INTENSE = 2

	Frequency	Intensity	Frequency x Intensity	Severity
1. Burning				
2. Itching				
3. Feeling of a foreign body				
4. Tearing				
5. Excessive binking				
6. Eye redness				
7. Eye pain				
8. Heavy eyelids				
9. Dryness				
10. Blurred vision				
11. Double vision				
12. Difficulty focusing for near vision				
13. Increased sensitivity to light				
14. Coloured halos around objects				
15. Feeling that eyesight is worsening				
16. Headache				

TOTAL SCORE = $\sum_{i=1}^{16}$

If the total score is ≥ 6 points, the worker has Computer Vision Syndrome.

ANNEXURE 5

MASTER CHART

DIGITAL EYE STRAIN

S.No.	DATE	NAME	AGE (In yrs)	GENDER	COLLEGE/ UNIVERSITY	AVG. SCREEN TIME (Weekly avg x 04) (In Hrs)(pre)	AVG. SCREEN TIME (Weekly avg x 04) (In Hrs)(post)	EYE POWER (If Specs) (in Dioptre)	BLINK RATE/MIN (PRE TEST)	BLINK RATE/MIN (POST TEST)	CVS-Q score (pre)	CVS-Q score (post)
1	06th june, 2025	SUBJECT 1	23	MALE	ABSMARI, OUHS	198	210	R: -4.75 L: -5.25	42 [8.4]	46. [9.2]	11	6
2		SUBJECT 2	21	MALE	ABSMARI, OUHS	226	220	R: -5.00 L: -5.00	32 [6.4]	32 [6.4]	9	6
3		SUBJECT 3	24	FEMALE	ABSMARI, OUHS	155	170	R: -3.00 L: -2.75	39 [7.8]	44. [8.8]	8	5
4		SUBJECT 4	25	MALE	ABSMARI, OUHS	180	170	R: - 0.00 L: -0.00	35 [7.0]	40. [8.0]	6	2
5		SUBJECT 5	26	FEMALE	ABSMARI, OUHS	208	200	R: - 2.25 L: -2.25	42 [8.4]	45 [9.0]	8	4
6		SUBJECT 6	20	MALE	ABSMARI, OUHS	230	245	R: - 0.00 L: -0.00	36 [7.2]	41. [8.2]	11	5
7		SUBJECT 7	20	MALE	ABSMARI, OUHS	154	170	R: - 0.00 L: -0.00	40 [8.0]	40. [8.0]	11	4
8		SUBJECT 8	20	MALE	ABSMARI, OUHS	210	160	R: - 0.00 L: -0.00	36 [7.2]	45 [9.0]	8	4
9		SUBJECT 9	20	MALE	ABSMARI, OUHS	174	180	R: - 0.00 L: -0.00	39 [7.8]	40. [8.0]	10	5
10		SUBJECT 10	18	MALE	ABSMARI, OUHS	255	160	R: - 0.00 L: -0.00	41 [8.2]	45 [9.0]	6	5
11		SUBJECT 11	21	FEMALE	ABSMARI, OUHS	203	200	R: - 0.75 L: - 0.50	38 [7.6]	40. [8.0]	9	3
12		SUBJECT 12	19	FEMALE	ABSMARI, OUHS	248	210	R: - 0.00 L: -0.00	38 [7.6]	40. [8.0]	7	5
13		SUBJECT 13	18	MALE	ABSMARI, OUHS	310	260	R: - 0.00 L: -0.00	32 [6.4]	42. [8.4]	8	5
14		SUBJECT 14	25	MALE	ABSMARI, OUHS	185	170	R: - 0.00 L: -0.00	44 [8.8]	50. [10.0]	7	6
15		SUBJECT 15	24	MALE	ABSMARI, OUHS	326	330	R: - 0.00 L: -0.00	30 [6.0]	41. [8.2]	13	9
16		SUBJECT 16	25	MALE	ABSMARI, OUHS	210	210	R: - 2.25 L: -2.25	34 [6.8]	42. [8.4]	9	4
17		SUBJECT 17	25	MALE	ABSMARI, OUHS	224	210	R: - 0.00 L: -0.00	40 [8.0]	60. [12.0]	7	5
18	10th june, 2025	SUBJECT 18	20	MALE	ABSMARI, OUHS	230	220	R: - 0.00 L: -0.00	43 [8.6]	43. [8.6]	6	7
19		SUBJECT 19	19	FEMALE	ABSMARI, OUHS	290	260	R: - 0.00 L: -0.00	38 [7.6]	43. [8.6]	14	7
20		SUBJECT 20	25	FEMALE	ABSMARI, OUHS	227	220	R: - 0.00 L: -0.00	36 [7.2]	43. [8.6]	7	5
21		SUBJECT 21	24	FEMALE	ABSMARI, OUHS	233	210	R: - 0.00 L: -0.00	31 [6.2]	46. [9.2]	9	7
22		SUBJECT 22	25	FEMALE	ABSMARI, OUHS	210	240	R: - 0.00 L: -0.00	30 [6.0]	37. [7.4]	13	10
23		SUBJECT 23	26	FEMALE	ABSMARI, OUHS	186	190	R: - 1.00 L: -1.75	39 [7.8]	46. [9.2]	10	6
24		SUBJECT 24	23	FEMALE	ABSMARI, OUHS	124	160	R: - 1.50 L: -1.00	42 [8.4]	46. [9.2]	10	8
25		SUBJECT 25	24	FEMALE	ABSMARI, OUHS	205	180	R: - 0.00 L: -0.00	32 [6.4]	50. [10.0]	7	6

ANNEXURE 6

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