Beyond Yoga Mat To Vision Chart: Bridging Yoga With Ocular Health.

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ABSTRACT

Background: Myopia is an increasingly prevalent refractive error among adolescents often accompanied by visual discomfort and functional limitations. Traditional management strategies may be inaccessible to large populations highlighting the need for cost-effective and non-pharmacological interventions. Yoga an ancient mind–body discipline has shown potential benefits for ocular health, yet robust randomized controlled evidence remains limited.

Objective: To evaluate the effects of a structured yoga intervention on visual acuity, refractive error and myopic symptoms among adolescents diagnosed with myopia.

Methods: A two-arm pretest-posttest randomized controlled trial was conducted to evaluate the efficacy of a 90-day yoga intervention in 120 myopic adolescents (aged 10-19 years). Participants were randomized to either a yoga intervention group (n = 60) or a no-intervention control group (n = 60). Outcome measures including visual acuity (snellen's chart), refractive error (auto refractometer) and myopic symptoms (questionnaire) were evaluated at baseline and post-intervention. Statistical analysis was performed using paired t-tests and Pearson's Chi-square tests.

Results: The experimental group demonstrated a statistically significant improvement in visual acuity for the right eye (mean difference = 6.15, $p < 0.05$) and left eye (mean difference = 5.75, $p < 0.05$). Refractive error also showed significant improvement in the right eye (−0.362 D, $p < 0.05$) and left eye (−0.292 D, $p < 0.05$). Post-intervention analysis indicated a significant improvement on myopic symptoms in the yoga intervention group compared to the control group across all assessed parameters.

Conclusion: The structured yoga intervention significantly improved visual acuity, refractive error and alleviated myopic symptoms in adolescents. Yoga may serve as an effective adjunctive strategy for myopia management and ocular health promotion in school-aged adolescents..

Keywords: Yoga, Visual Acuity, Refractive Error, Myopic symptoms, Eye Health
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INTRODUCTION

Originating in India, yoga has transformed into a globally embraced mind-body discipline promoting holistic well-being and balance across physical, emotional and mental domains.[i] A growing body of research underscores yoga's therapeutic potential in addressing diverse health issues notably eye health where it has demonstrated efficacy in mitigating symptoms of eye strain, fatigue and vision-related disorders.[ii] [iii] [iv] India being the cradle of yoga is an enduring tradition that has been transmitted across millennia offering a profound means of nurturing inner tranquility and well-being.[v] The ancient practice of yoga deeply rooted in Indian heritage is referenced in revered scriptures such as the Rig Veda where it played a pivotal role in Vedic ceremonial practices.[vi] Yoga's evolution was shaped by the contributions of esteemed sages notably Patanjali whom ultimate role being transcending its Indian origins worldwide to achieve global recognition and adoption.[vii] Swami Vivekananda underscored yoga's significance as a means of facilitating individuals' connection to a transcendent or higher reality.[viii] The eye's intricate structure makes it vulnerable to disruptions that can profoundly impact daily functioning and quality of life, underscoring the importance of effective ocular management and treatment strategies. Early-life visual disturbances including strabismus or anisometropia can disrupt neural visual pathways, potentially leading to persistent vision impairments[ix]. In the US an estimated 8.2 million individuals aged ≥12 years have uncorrected refractive errors highlighting a significant public health concern.[x] The prevalence of myopia is escalating particularly in East and Southeast Asia where approximately 80%–90% of the population is affected.[xi] Myopia progression rates vary among ethnic groups with Europeans showing a mean annual progression of -0.55D while Asians exhibit a slightly higher rate of -0.82D.[xii] The

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Northern Indian Myopia Study involving 10,000 school children (5-15 years) reported an annual myopia progression of -0.27 ± 0.42 D in India.[xiii] A recent hospital-based study on Indian children and young adults found that 4.3% of myopes exhibited pathologic myopia, a prevalence comparable to that observed in Caucasians and East Asians.[xiv xv] In emmetropic eyes distant objects are focused clearly without optical adjustment. The eye's refractive state changes with age hypermetropic (1-3D) at birth, becomes emmetropic by 5-7 years, remains stable until around 50 and then shifts toward hypermetropia (1-3D) in old age due to crystalline lens changes.

Visual acuity evaluates the precision of vision indicating the smallest discernible detail and is expressed as the reciprocal of the minimum resolvable visual angle (in minutes of arc) for a standardized test stimulus.[xvi] Now a days avoidable vision impairment occurs frequently worldwide. The human eyeball is a nearly spherical, hollow structure with an anteroposterior diameter of approximately 24 mm and a transverse diameter of 23.5 mm exhibiting minor variations in individuals with refractive errors such as myopia or hyperopia[xvii].

Myopia was first defined by Kepler (1611), linked to eyeball elongation by Plempius (1632) and clinically established by Donders (1866). The term "myopia" derives from the squinting habit used to compensate for blurred distance vision.[xviii] Myopia (nearsightedness) arises when light converges anterior to the retina, blurring distant vision typically due to an elongated axial length representing the refractive inverse of hypermetropia. Severe myopia increases the risk of sight-threatening complications including macular degeneration, glaucoma, cataract, retinal detachment and blindness, ultimately compromising quality of life.[xix] Prolonged use of digital devices at close range can contribute to the development of myopia often referred as digital eye strain syndrome.[xx] The substantial prevalence of poverty in India renders regular eye care and corrective interventions a luxury for millions, underscoring the imperative to prioritize targeted strategies that alleviate visual impairment and enhance overall quality of life. [xxi]

2. METHODOLOGY

Study Design

A parallel-group, pretest-posttest randomized controlled trial (RCT) was designed to investigate the effects of a structured yoga intervention on visual acuity, refractive error and myopic symptoms among adolescents. In view of the increasing prevalence of ocular problems among school-going children in the Dehradun region, Shri Guru Ram Rai Public School, Sahastradhara Road, Dehradun, was purposively selected as the study site. Initial screening was conducted using a questionnaire focusing on nearsightedness related (myopic) symptoms. Students who reported symptoms suggestive of myopia were shortlisted for further evaluation resulting in a preliminary sample of 200 adolescents.

These shortlisted students were subsequently referred to Shri Guru Ram Rai Institute of Medical & Health Sciences, Dehradun where comprehensive ophthalmic examinations were conducted by qualified ophthalmologists and optometrists. The clinical assessment included visual acuity, refractive error and myopic symptom. Following detailed examination, 120 adolescents were diagnosed with myopia and were therefore enrolled in the study. Assessments were performed at baseline and post-intervention over a 90-day period The myopic symptom questionnaire used in the study was content-validated prior to data collection by a panel of experts comprising ophthalmologists, optometrists, medical practitioners and academic faculty.

Inclusion Criteria

Adolescents aged **10–19 years**.

Clinically diagnosed with **myopia (refractive error)**.

Reduced **distance visual acuity** with myopic refractive error.

Presence of **myopic symptoms** such as blurred distance vision, eye strain, headache, or difficulty seeing the blackboard.

Willingness to participate in the study and ability to comply with the **90-day yoga intervention protocol**.

Written informed consent obtained from parents/guardians.

Exclusion Criteria

Presence of **ocular pathologies** other than myopia (e.g. cataract, glaucoma, strabismus, amblyopia, retinal disorders).

History of **ocular surgery** or trauma.

High or pathological myopia requiring immediate medical or surgical intervention.

Presence of **systemic or neurological disorders** affecting vision.

Current participation in any **structured yoga, eye exercise or vision therapy program**.

Use of medications known to influence visual function.

Adolescents with **inability to follow instructions** or irregular attendance during the intervention period.

Ethical Considerations

The study was approved by the Institutional Ethics Committee of Shri Guru Ram Rai Institute of Medical and Health Sciences, Dehradun on 26 April 2025 (Ref. No. SGRR/IEC/17/25) and was conducted in accordance with the principles of the Declaration of Helsinki. Permission was obtained from the school authorities prior to participant recruitment. Written informed consent was obtained from the parents or legal guardians of all participants. Participants were fully informed about the study objectives, procedures, potential benefits and their right to withdraw at any stage without any academic or personal consequences. The confidentiality and anonymity of all participants were strictly maintained and the collected data were used exclusively for research purposes.

Intervention

The structured yoga intervention was administered for a total duration of 90 consecutive days, with each session lasting for 60 minutes and conducted on a daily basis under supervision. Each session began with an opening prayer (Mahamrityunjaya Mantra) to promote mental relaxation and focus. This was followed by Shatkarma practices including Jal Neti **fig:1**, Rubber Neti and Trataka, which were incorporated to enhance nasal hygiene, ocular cleansing and visual concentration. A sequence of yogic postures (asanas) such as Surya Namaskar **fig:2&3**, Vrikshasana (Tree Pose), Shashankasana (Rabbit Pose), Marjariasana (Cat–Cow pose) and Shavasana (corpse pose) was then performed to improve systemic circulation, postural balance, relaxation of ocular muscles and overall physical well-being. Breathing regulation was addressed through Nadi Shodhana Pranayama to promote autonomic balance and reduce ocular strain. This was followed by the practice of Shambhavi Mudra aimed at enhancing ocular focus and neuromuscular coordination. Mantra chanting (Chakshushi Mantra) constituted a major component of the session emphasizing sustained attention and visual relaxation. Each session concluded with the recitation of the Shanti Path to induce a state of calmness. The duration, number of repetitions and sequence of practices were standardized across participants to ensure intervention consistency throughout the study period.

Table 1. Structured Yoga Intervention Protocol (90 Consecutive Days; 60 Minutes per Session)

Component	Yoga Practices	Duration per Practice (min)	Rounds/Repetitions	Frequency	Intervention Period
Opening Prayer	Mahamrityunjaya Mantra	3			
Shatkarma (Cleansing Techniques)	Jal Neti	5			
	Rubber Neti	5			
	Trataka	10			
Asanas (Postures)	Surya Namaskar	3			
	Vrikshasana (Tree Pose)	2			
	Shashankasana (Rabbit Pose)	1			
	Marjariasana (Cat–Cow)	1			
	Shavasana (Corpse Pose)	3			
Pranayama (Breathing Practice)	Nadi Shodhana Pranayama	5			
Mudra	Shambhavi Mudra	5			
Mantra Chanting	Chakshushi Mantra	15			
Closing Prayer	Shanti Path	2			
Total Session Duration	—	**60 minutes**			

Flow diagram:

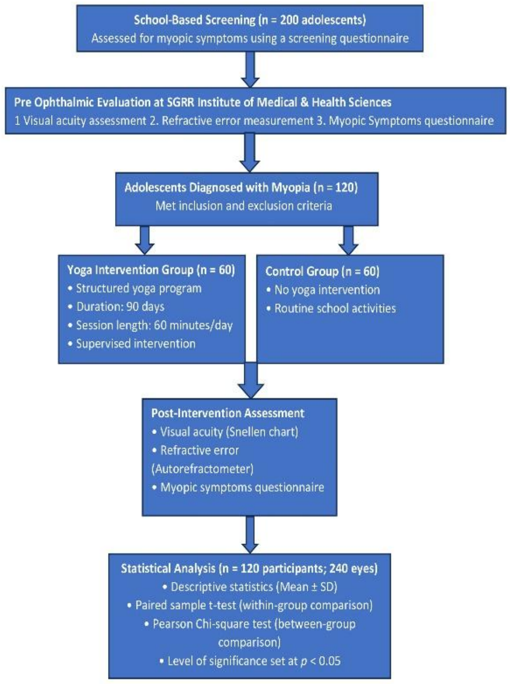


Fig:1 Students performing Jalneti **Fig: 2&3 Students performing Suryanamaskar**

Assessment Tools

1. **Visual acuity test** was evaluated using a standardized vision chart under uniform illumination. Assessments were conducted for each eye separately with the non-tested eye properly covered. All participants were examined at a predetermined distance and the smallest row of optotypes that could be accurately identified was documented as the individual's visual acuity score Visual acuity measured with the **Snellen chart Fig: 4,5&6** is represented as a ratio that compares the testing distance to the distance at which the same optotype is normally recognized by an individual with standard vision **VA=Distance from chart / Distance normal eye sees**. For instance, a Snellen value of 6/6 reflects normal visual resolution whereas a value of 6/12 indicates that the individual is able to perceive at 6 meters what a person with normal vision can distinguish at 12 meters. Smaller denominator values correspond to superior visual acuity while larger denominators denote diminished visual clarity. [xxii xxiii xxiv]

2. Refractive error test was assessed using standard optometric procedures under controlled clinical conditions. Measurements were obtained monocularly for both eyes by trained eye-care professionals before and after the intervention.[xxv] Initial refractive measurements were obtained using an **Autorefractometer** (ARK-1) **Fig: 7,8&9** which provides an objective estimation of the eye's refractive status by analyzing the reflection of infrared light from the retina. The Spherical Equivalent (SE) calculation combines sphere and cylinder values to provide a single measure of refractive error facilitating data analysis and comparisons in clinical and research contexts. Spherical Equivalent **(SE) = Sphere + (Cylinder / 2)**. Multiple readings were taken for each eye and the average value was recorded to improve reliability.[xxvi] The measurements were further verified using trial lenses to ensure accuracy.[xxvii] Refractive error values were recorded in diopters for a total of 240 eyes (120 participants × 2 eyes). [xxviii xxix]

3. **Myopic symptoms** were assessed using a content-validated **questionnaire** administered at baseline and post-intervention. **Fig: 10,11&12**

Statistical Analysis

Data analysis was conducted using SYSTAT version 13 and Microsoft Excel. Data were summarized using descriptive statistics including mean and standard deviation. The normality of data distribution was assessed prior to analysis. Paired sample t-tests were applied to evaluate differences between pre- and post-intervention measurements for both eyes. A p-value < 0.05 was considered statistically significant.

VISUAL ACUITY TEST

Table 1. Illustrates the pre-test and post-test mean values for the right eye (RE) and left eye (LE).

Variable	N	Mean	Variable	N	Mean
PRE_RE	60.000	16.300	PRE_LE	60.000	17.05(
POST_RE	60.000	10.150	POST_LE	60.000	11.30(

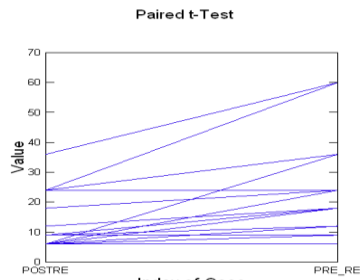
Table 2 & 3 Shows the mean difference, variability of the difference and statistical significance (*p*-value) for the right and left eyes respectively

Table 2.

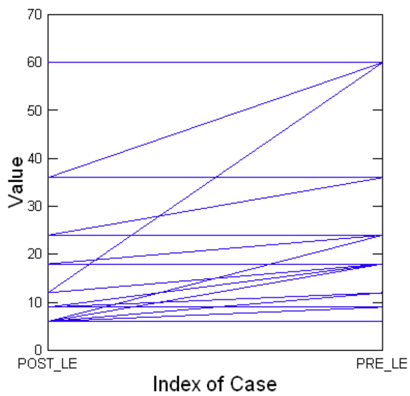
Variable	Mean Difference	95.00 % Confidence Bound	Standard Deviation of Difference	t	df	p-Value
PRE_RE	6.150	4.554	7.399	6.439	59.000	**0.000**
POST_RE						

Table 3.

Variable	Mean Difference	95.00% Confidence Interval		Standard Deviation of Difference	t	df	p-Value
		Lower Limit	Upper Limit				
PRE_LE	5.750	3.792	7.708	7.579	5.876	59.000	**0.000**
POST_LE							



Paired t-Test



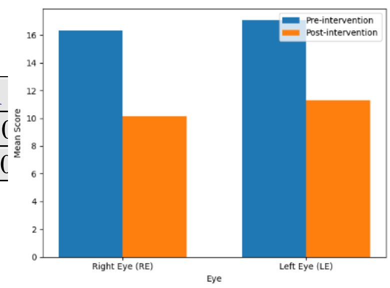


Fig: 4,5&6 Students performing Visual acuity test

REFRACTIVE ERROR TEST

Table 4. Illustrates the pre-test and post-test mean values for the right eye (RE) and left eye (LE).

Variable	N	Mean	Variable	N	Mean
PRE_REF_RE	60.000	-1.317	PRE_REF_LE	60.000	-1.350
POST_REF_RE	60.000	-0.954	POST_REF_LE	60.000	-1.058

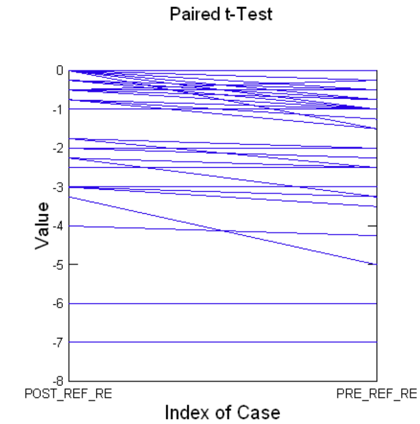
Table 5&6 Shows the mean difference, variability of the difference and statistical significance (*p*-value) for the right and left eyes respectively

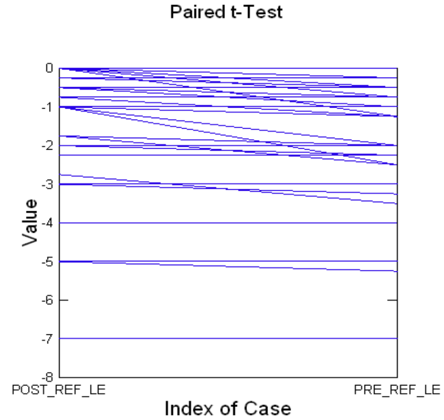
Table 5.

Variable	Mean Difference	95.00% Confidence Interval		Standard Deviation of Difference	t	df	p-Value
		Lower Limit	Upper Limit				
PRE_REF_RE / POST_REF_RE	-0.362	-0.457	-0.268	0.367	-7.660	59.000	**0.000**

Table 6.

Variable	Mean Difference	95.00% Confidence Interval		Standard Deviation of Difference	t	df	p-Value
		Lower Limit	Upper Limit				
PRE_REF_LE / POST_REF_LE	-0.292	-0.374	-0.209	0.319	-7.072	59.000	**0.000**





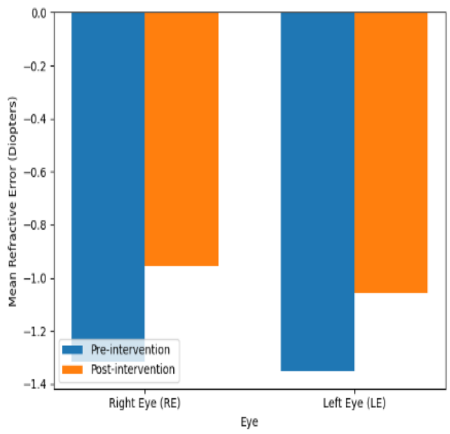


Fig: 7,8&9 Students performing Autorefractometer test

SYMPTOM TEST

Table 7. Showing post-intervention symptom frequencies in the control and experimental groups

S. No.	MYOPIC SYMTOMS IN ADOLESCENTS	Control Group (60 students): Myopic Symptoms (Yes / No)		Experimental Group (60 students): Myopic Symptoms (Yes / No)		Total No. of Students	Test Statistic Pearson Chi-Square Value	p-Value
	POST_DISTANT	57	3	20	40	120	49.616	< 0.05
	POST_EYE_STRAIN	56	4	21	39	120	44.397	< 0.05
	POST_BLURRY	58	2	25	35	120	42.553	< 0.05
	POST_FRONTAL HEADACHE	59	1	17	43	120	63.301	< 0.05
	POST_SQUINT	57	3	23	37	120	43.350	< 0.05
	POST_DISCOMFORT	55	5	19	41	120	45.687	< 0.05
	POST_PHOTOPHOBIA	58	2	18	42	120	57.416	< 0.05
	POST_BLACKBOARD	57	3	27	33	120	35.714	< 0.05
	POST_BLINKING	55	5	22	38	120	39.468	< 0.05
	POST_RUBBING	56	4	20	40	120	46.507	< 0.05

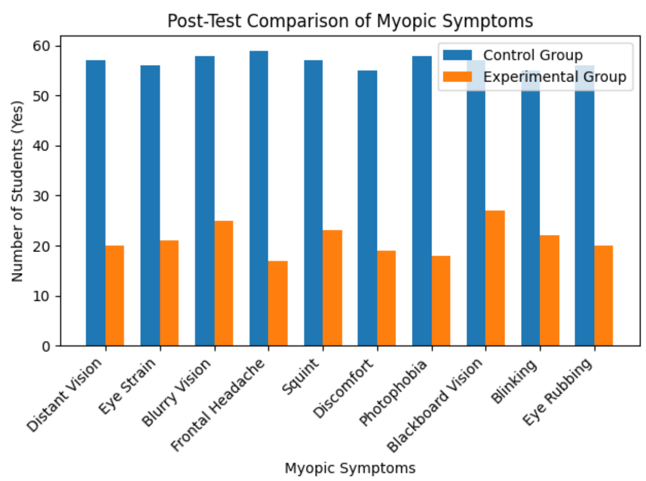


Fig: 10,11&12 Students performing symptom test by filling questionnaire form

Results

Visual Acuity Outcomes

Within-group analysis using paired sample *t*-tests demonstrated a statistically significant improvement in visual acuity in the experimental group following the yoga intervention. Mean right-eye visual acuity scores improved from 16.30 at baseline to 10.15 post-intervention (mean difference = 6.15; $t = 6.439$; $p < 0.001$). Similarly, left-eye visual acuity improved significantly with mean scores from 17.05 to 11.30 (mean difference = 5.75; $t = 5.876$; $p < 0.001$).

Refractive Error Outcomes

Significant improvement in myopic refractive error was observed in the experimental group following the intervention. The mean spherical equivalent of the right eye improved from −1.317 D at baseline to −0.954 D post-intervention (mean difference = −0.362 D; $t = -7.660$; $p < 0.001$). Correspondingly, the left eye showed an improvement from −1.350 D to −1.058 D (mean difference = −0.292 D; $t = -7.072$; $p < 0.001$).

Myopic Symptoms Outcomes

At baseline 100% of participants in both groups reported the presence of all assessed myopic symptoms. Post-test assessment revealed minimal change in the control group with symptom prevalence remaining between 1.7% and 8.3% across parameters.

In contrast the experimental group exhibited substantial improvement in symptom prevalence following the yoga intervention. Post-test symptom levels improved to 66.7% for difficulty in distant vision, 65% for eye strain, 58.3% for blurry vision, 71.7% for frontal headache and 61.7% for squinting. Improvement was also observed for ocular discomfort (68.3%), photophobia (70%), difficulty in blackboard vision (55%), frequent blinking (63.3%) and eye rubbing (66.7%).

Between-group comparison of post-test symptom distribution demonstrated a consistently higher prevalence of myopic symptoms in the control group. Pearson Chi-square analysis indicated a substantial divergence in symptom distribution between the experimental and control groups across all assessed variables.

DISCUSSION

The observed improvements in visual acuity, refractive error and myopic symptoms may be attributed to the integrated ocular, neurological and autonomic effects produced by systematic yogic practices .[xxx] Visual concentration techniques such as Trataka and Shambhavi Mudra emphasize sustained yet relaxed gaze fixation which may enhance accommodative adaptability and reduce accommodative spasm resulting from prolonged near-vision tasks (Saraswati, 2012; Hatha Yoga Pradipika, 2006).[xxxi] [xxxii]These practices are further believed to strengthen neuromuscular coordination of the extraocular muscles thereby improving visual stability and efficiency .[xxxiii] Pranayama techniques particularly Nadi Shodhana are known to regulate autonomic function by reducing sympathetic dominance and enhancing parasympathetic activity which has been associated with reduced ocular fatigue and visual discomfort .[xxxiv] [xxxv]Improved autonomic regulation has also been linked to decreased digital eye strain and enhanced visual comfort among adolescents and young adults (Telles, Naveen, & Dash, 2007).[xxxvi] Yogic relaxation practices and asanas may additionally promote improved periocular blood circulation and muscular relaxation thereby alleviating visual stress and symptom burden.[xxxvii] [xxxviii]

Traditional cleansing techniques such as Jal Neti are believed to support ocular health by improving nasal and sinus patency which may enhance tear duct function thus reducing craniofacial congestion and indirectly alleviate eye strain and myopia-related discomfort (Jalan, 1979).[xxxix] Similarly Rubber Neti may reduce sinus pressure and nasal obstruction, indirectly benefiting ocular comfort through improved respiratory and circulatory efficiency (Gheranda, 1979).[xl] The inclusion of structured asana practices such as Surya Namaskar, Vrikshasana, Shashankasana, Marjaryasana and Shavasana may further contribute to ocular well-being by improving systemic circulation, reducing psycho-physiological tension and inducing neuromuscular relaxation (Iyengar, 1993; Saraswati, 2008). These postures are traditionally described as enhancing balance, concentration, spinal flexibility and nervous system calmness, all of which may positively influence visual function.[xli]

The incorporation of pranayama and mudra practices may further support ocular health by improving oxygenation, calming the mind, reducing headache frequency and alleviating eye strain (Singh, Bhargav, & Srinivasan, 2016).[xlii] Shambhavi Mudra is believed to enhance inner awareness, mental steadiness and visual focus, thereby contributing to reduced visual fatigue (Sharma & Sharma, 2010). The concluding recitation of the Chakshushi Mantra may have additionally promoted mental tranquility and psychosomatic relaxation which are traditionally associated with ocular healing and visual clarity (Sharma, 2002; Shastri, 2017).[xliii] [xliv]The holistic nature of the yoga intervention may also have increased participants' mindfulness regarding visual habits, encouraging healthier eye-care behaviours and improved adherence to visual hygiene practices (Ross & Thomas, 2010). Collectively, these interconnected mechanisms may explain the bilateral and systemic improvements observed in the present study, supporting yoga as a complementary, non-invasive and cost-effective approach for managing myopia-related visual disturbances in adolescents (Gopinathan & Dharmarajan, 2019; Brown & Gerbarg, 2005).

CONCLUSION

The findings of this randomized controlled trial provide strong evidence that a 90-day structured yoga intervention significantly improves visual acuity, reduces refractive error and alleviates myopic symptoms in adolescents. Yoga may serve as an effective complementary approach to conventional myopia management strategies, particularly in resource-limited settings. Incorporating yoga-based ocular health practices into school curricula may contribute to long-term visual well-being and improved quality of life among adolescents.

LIMITATIONS

Despite the promising findings, certain limitations should be acknowledged. First, the study was conducted at a single school in the Dehradun region which may limit the generalizability of the results to other populations or geographical settings. Second, the intervention duration was limited to 90 days so long-term sustainability of the observed improvements in visual acuity and refractive error could not be assessed. Third, although randomization was performed the masking of participants was not feasible due to the nature of the yoga intervention which may introduce performance bias.

Future Scope

Future studies should consider multicentric trials with larger and more diverse samples to enhance external validity. Longitudinal follow-up is recommended to evaluate the long-term impact of yoga on myopia progression and ocular structural parameters. Comparative studies assessing yoga alongside conventional myopia control strategies may further clarify its role as a complementary or preventive approach in adolescent eye care.

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