

Role of Yoga and Ocular Exercises in Refractive Errors - A Review

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Abstract: *Our eyes are the body's most well - developed sensory organs. Indeed, a far larger part of our brain is devoted to the functions of eyesight than to those of hearing, taste, touch or smell together. We usually take our eyesight for granted, although when vision problems develop, most of us will do everything in our capacity to restore our eyesight to normal. In the present era, there are lots of causes which can disturb the natural health of the eyes like continuous work on a computer, watching television for a long time, very frequent & prolonged use of mobile phones, night arousal, pollution, reading in a poor source of light, unhealthy diet habits etc. Eyes work together to perceive depth thus allowing us to coordinate with motor actions. Practicing relaxation exercises and eye exercises has been shown to improve motor functions and attention. Yoga procedures like Pranayama, Trataka and Jala Neti (one of the procedures in Shatkarma) are recommended with high emphasis. The present review study is an effort to highlight the efficacy of Yoga in the management of refractive errors. For this study, a total of 6 articles were collected from the internet and were critically analyzed and compiled. All these studies showed significant improvements in signs and symptoms developed in refractive errors. However, those studies were conducted on a small sample size. So, for strong evidence of the role of Yoga in refractive errors, a greater number of research works should be carried out in a large sample size.*

Keywords: Neti, Pranayama, Refractive error, Trataka, Yoga

1. Introduction

Nowadays, there are various electronic instruments like mobile, TV, computers, etc. are available in the market, which affects the eyes more. Globally, 1 billion people have a vision impairment that could have been prevented or has yet to be addressed. This 1 billion people including those with moderate or severe distance vision impairment or blindness due to unaddressed refractive error is 123.7 million. [1] Rates vary between regions of the world with about 25% of Europeans and 80% of Asians affected. [2] Near - sightedness is the most common disorder. Rates among adults are between 15 - 49% while rates among children are between 1.2 - 42%. [3] Far - sightedness more commonly affects young children and the elderly. The number of people with refractive errors that have not been corrected was estimated at 660 million (10 per 100 people) in 2013. Of these 9.5 million were blind due to the refractive error. [4] The overall incidence of refractive error has been reported to vary between 21% and 25% of the patients attending eye OPD in India. [5] About 13% of the Indian population is in the age group of 10 - 15 years. Poor vision in childhood affects performance in school or at work and has a negative influence on the future life of the child. Moreover, planning a youth's career is very much dependent on visual acuity, especially in jobs for the navy, military, railways, and aviation. This warrants early detection and treatment of refractive errors to prevent permanent disability. While analyzing the etiology of refractive errors, today's lifestyle, occupation, and unawareness of the importance of the eye have a great impact on ocular health. *Yoga* is an ancient Indian science that includes the practice of specific postures, cleansing practices, regulated breathing and meditation. A combination of *Yoga* practices reduced symptoms of visual strain in persons with progressive myopia. [6] *Yoga* eye exercises are supposed to strengthen all the extraocular muscles and help prevent eye strain. *Yoga*

has been shown to improve ocular symptoms in people who use computers for prolonged hours. [7] Even a short program of *Yoga* of six weeks was found to be effective in enhancing emotional well - being and resilience to stress among employees of a workplace. [8] Telles et al showed improvement in mirror tracing tasks after one month of *Yoga* training. [9]

Definition of Refractive errors [10]

To allow us clear vision, light rays reflected from objects towards which we are looking cross four successive eye regions: the cornea, the aqueous humour, the crystalline lens, and the vitreous body. Every time a light ray crosses one of these regions, its path deviates at a certain angle in a phenomenon called refraction. These combined actions result in the convergence of light rays on the retina, allowing a clear view of the object. When light rays converge in front of or behind the retina, instead of directly on it, the patient is said to have refractive errors. As a consequence of this, images are blurred.

Possible manifestations of this condition are:

Myopia: Myopia or short - sightedness is a type of refractive error in which parallel rays of light coming from infinity are focused in front of the retina when accommodation is at rest.

Astigmatism: It is a state of refractive error in which the refraction varies in different meridians. Consequently, the rays of light entering in the eye cannot converge to a point focus but form focal lines.

Hypermetropia: It is the refractive state of the eye wherein parallel rays of light coming from infinity are focused behind the retina with accommodation being at rest. Thus, the posterior focal point is behind the retina, which therefore receives the blurred image.

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Ocular Exercises in Refractive Errors

India, Eye Exercises were started in The School for Perfect Eyesight in Sri Arbindo Ashram, Pudducherry (Pondicherry), decades ago, on May 5: 1968, at the efforts of an Ophthalmologist, the Late Dr. Raghubir Sharan Agrawal, a staunch disciple of the renowned Spiritual leader Sri Arbindo. [11]

Methods of eye exercises are Sunning, Eyewash, stretching of eye muscles, Eye blinking, Palming, Candlelight reading, Shifting and Swinging, Playing with ball, Vaporization and Cold pad.

Eye Exercise works on the principles of elimination of toxic materials from the eyes, stimulation of eyes & muscles, and relaxation of eyes & mind. [12] Before starting eye exercises, it is always recommended to splash the eyes with cold water a few times and head & spine position should be straight throughout the exercises. [13]

YOGA IN REFRACTIVE ERRORS:

Neti (Nasal cleansing):

It is one of the important *Shatkarma* because it removes the mucus blocking from nasal passage which is important before practicing *Pranayama*. [14] The tear ducts, which connect the eyes to the nasal passage, get the same drawing - out effect as the sinuses, resulting in a brighter, clearer sense of vision. It was done with proper procedure daily in the morning. For *Neti Kriya* insert thread or catheter straight into the left nostril and gently push so that it slowly passes down into the throat. Slowly and gently pull the thread out backward and forwards thirty to fifty times. Perform in the same way through the opposite nostril. [15]

Benefits: *Neti* cleanses the cranium and bestows clairvoyance. It also destroys all diseases which manifest above the throat. *Neti* helps to maintain nasal hygiene by removing the dirt and bacteria trapped along with the mucus in the nostrils. It can clear the eye ducts and improve vision. It can remove tensions and depression; and give clarity of mind.

Pranayama:

Anulom Vilom or *Nadi Shodhana Pranayama* clears the blocked energy channels (*Nadis*) and calms the mind. *Yogis* have been practicing this breath control technique to rejuvenate their senses for centuries. For *Pranayama* sit relaxed with *Pranayama Mudra* and concentrate on the normal breath for a few minutes. Close the right nostril with the thumb. Breathe through the left nostril 20 times - the breath is slightly deeper than normal and directed into the abdomen. Repeat the same procedure on the opposite side.

Benefits: *Nadi Shodhana* purifies the blood and respiratory system. The deeper breathing enriches the blood with oxygen. This *Pranayama* strengthens the respiratory system and balances the nervous system. It helps to relieve nervousness and headaches. It will improve eyesight because there will be less stress on your body and mind.

Trataka:

Trataka Kriya [16] is described in various scriptures, in the classics. *Trataka* means to gaze steadily. It is practiced in

one of the *Shat Karmas*. It acts as a bridge between *Yoga* and *Raja Yoga*. There are two forms of practice, one is *Bahiranga* or external *Trataka* and the other is *Antaranga* or internal *Trataka*. *Bahiranga* is simpler to practice because we just have to gaze at an object or symbol like candle flame, crystal ball, full moon, a star, the rising or setting sun, a chakra, the symbol of Om etc. to the extent that you may shed tears from your eyes. However, *Antarangatratataka* involves clear and stable inner visualization of an object. [17]

Benefits: *Trataka* eradicates all eye diseases, fatigue and sloth and closes the doorway creating these problems. It benefits not only the eyes, but a whole range of physiological and mental functions. [18] Its most important effect is on *Agya Chakra* and the brain. The *Gheranda Samhita* mentions that it promotes the perception of subtle manifestations. The other purpose is to make the mind completely one - pointed and to arouse inner vision i. e. *Ekagrata*.

2. Observation and Results

Trial 1:

"Effect Of Pranayama And Eye Exercises On Eye To Hand Coordination: Study By Finger Dexterity Test" - *Nitin Gosewade, Vinod Shende, Chhaya Saraf, Amol Drugkar*

In a study carried out in the Physiology Department, Seth G. S Medical College & KEM Hospital, and Mumbai total of 60 young healthy subjects (both male and female) who were in the first year MBBS at Seth GSMC Mumbai, in the age group of 18–30 years with or without refractory error and who belonged to similar socio - economic status were recruited in the study. All the study participants were staying in a college hostel having similar eating and sleeping patterns. 60 healthy subjects were divided equally into two groups. One group practiced *Kapalabhati Pranayama* and eye exercises for eight weeks whereas the other group did not participate in any kind of exercise. Baseline finger dexterity test values were recorded from each study participant irrespective of their group before starting the study. Study group participants were taught eye exercises and *Kapalabhati Pranayama*. They practiced eye exercises and *Pranayama* twice a day for (a total of one hour) for 8 weeks regularly under supervision. Control group participants were busy with their routine activities and were not given any exercise. After 8 weeks Finger dexterity test was performed on all subjects to see the effect of eye exercises along with *Kapalabhati Pranayama* on eye - to - hand coordination. The effect of *Pranayama* and eye exercises on eye - to - hand coordination was assessed by finger dexterity test by using the O'Connor finger dexterity task. There was a significant improvement in eye - to - hand coordination in subjects practicing *Pranayama* and eye exercises. Finger dexterity test values in the study group before and after intervention were 31 ± 4.94 and 33 ± 4.98 respectively. Whereas in the control group the values were 29.9 ± 5.7 and 30.1 ± 5.31 respectively. Results suggested that there was a significant improvement in eye - to - hand coordination in subjects practicing *Pranayama* along with eye relaxation exercises as compared with a control group. [19]

Trial 2:

"Efficacy Of *Trataka* In Improvement Of Vision In Myopic And Hypermetropic Children" - *Badwaik Premkumar Panjabrao*,

In this study, the efficacy of *Trataka* was studied in two groups i. e., myopic and hypermetropic between the ages of 13 to 16 years with 20 children in each group having symptoms of Headache, Lacrimation of eye, ocular pain, and fatigue. On the first day, every volunteer was examined for refraction and the record was maintained. *Trataka Kriya* was explained to them by the faculty. One 5 mm dot was drawn on century paper. The paper was pasted at 1 & ½ feet on the wall in a room where *Trataka* was performed for 20 minutes. After every 15 days, follow - up was taken up to 3 months (6 follow - ups). After every 15 days follow - up of refraction was done. After completion of 3 months study it was observed in the myopic group that Diminished Ophthalmic Vision is reduced to 90%. Headache is reduced by 66.67%, lacrimation of eyes is reduced to 84.62%, ocular pain is decreased up to 85.71% & eye fatigue is reduced by 65.22%. In a hypermetropic group of children, it was observed that Diminished Ophthalmic Vision is reduced to 48.78%, headache is reduced to 69.56%, lacrimation of eyes is cured up to 56.25%, ocular pain is reduced to 61.90% and eye fatigue is reduced to 63.15%. So *Trataka* plays an important role in Myopia and Hypermetropia in children. It can be recommended to minimize the refractive error. [20]

Trial 3:

"Effect of Yogic Exercise on Myopia of High School Girls" - *Rajendra Lolage and Narayan Jadhav*.

This study was to measure the effect of *Yogic* exercise on Myopia in high school girls. This experiment therefore included thirty (N=30) high school girls aged ranged from 11 - 15 from Gujarati Kanyaprashala Gulmandi Aurangabad. The subjects were divided into two groups i. e. control group (n=15) and the experimental group (n=15) Initial test of Myopia was conducted on all subjects. In training in *Yogic* Exercise, I have included *OM Stawan, Anulom - Vilom, Kapalbhathi, Bhramari, Ujjayi Pranayama, OM* recitation, eye exercise *Tratak*, palming and *Yoga Nidra*. In the evening sixty min for each session of the day. Although the subjects of the control group did not practice in the above program, they were kept busy with interesting activities separately during the experimental period. After one month, training of *Yogic* exercise final test was conducted for the entire subjects. The obtained data was statistically analyzed by using the T ratio. The result, thus, revealed that *Yogic* Exercise has a favorable influence in improving the Eyesight of High school girls as measured through the Visual Acuity Test included in the present study. However, there was no change observed in the pre and post - test Mean of Myopia of the control group. [21]

Trial 4:

"A clinical study to evaluate the efficacy of *Trataka Yoga Kriya* and eye exercises (non - pharmacological methods) in the management of *Timira* (Ammetropia and Presbyopia) " - *G. Gopinathan, Kartar Singh Dhiman and R. Manjusha*.

In this study, a total of 66 patients were registered under two main groups with four sub - groups of refractive error like myopia, hypermetropia, astigmatism, and presbyopia, respectively, (Group A – 32 patients, Group B – 34 patients) by random sampling method with inclusion criteria of Sign and Symptoms showing *Prathama* (first) and *Dwitiya* (second) *Patalagata Timira* and asthenopic symptoms like headache, watering, ocular pain, and fatigue. In group A patients were subjected to perform a group of eye exercises once daily for 3 weeks. In group B patients were subjected to perform *Trataka Yoga Kriya* once daily (either in the morning or in evening hours) for 3 weeks. The present study shows that none of the patients were cured and markedly improved in the eye exercises group and the *Trataka* group. By eye exercises, moderate improvement was observed in one patient (3.20%), mild improvement was observed in 20 patients (64.45%), and no improvement was observed in 10 patients (32.25%) of *Timira*. Whereas by *Trataka*, moderate improvement was observed in two patients (6.25%), mild improvement was observed in 18 patients (56.25%) and no improvement was observed in 12 patients (37.5%) of *Timira*. Though the degree of improvement was almost similar in both groups, a better relief was appreciated by patients of the *Trataka Yoga Kriya* group. It is an encouraging finding that a non - pharmacological, low - cost, relaxation technique can improve the quality of vision, by which it indirectly checks the progression of the disease condition. [22]

Trial 5:

"Comparative study on the effect of *Saptamrita Lauha* and Yoga therapy in myopia" -

Charu Bansal.

In this study a total 60 patients of the age group 8 to 30 years were selected randomly from the outpatient Department of *Swasthavritta* and Department of *Shalakyatantra*, Government Ayurveda College, Trivandrum, with inclusion criteria Blurring (dimness) of distant vision, Difficulty in changing the focus from one distance to another, Head ache, Pain in the eye, Watering of the eye, Eye strain, Heaviness of the eye and Patient having myopia with refractive index up to - 6D and were treated in two groups. The 30 patients of Group A were treated with *Saptamritha Lauha* and patients of B Group in similar numbers were subjected to *Yoga* therapy. Analysis of the result on 60 patients of myopia showed that, in none of the groups, a statistically significant reduction in the V. A. and dioptic power was recorded in either of the eyes. However, associated changes were seen to be reduced. In Headache *Saptamrata Lauha* therapy (Group A) and *Jala Neti, Pranayama* and *Trataka* therapy (Group B) were equally effective ($P < 0.005$). However in the other symptoms like pain in the eye, watering in the eye, eye strain and heaviness of the eye Group B (*Jala Neti, Pranayama* and *Trataka* therapy) was more effective ($P < 0.005$). [23]

Trial 6:

"Effect of Yoga Eye Exercise on Medical College Students With Refractive Error" - *M. Ashok Kumar, A. R. Rajalakshmi, Monica Kumbhat*.

This study was planned among 30 medical college students who had a refractive error. All the subjects practiced *Yoga*

eye exercises for 6 weeks. A questionnaire of ocular symptoms, near point of accommodation (NPA), Near point of accommodation (NPC), fusion range (FR) and refractive error were evaluated before and after 6 weeks of *Yoga* eye exercise. FR improved from 11.630 ± 7.946 to 17.10 ± 9.019 and NPC from $8.00\text{cm} \pm 1.819$ to $5.07\text{cm} \pm 1.461$. The difference was statistically significant. NPA and status of refractive error showed no change. *Yoga* eye exercise for 6 weeks showed significant changes in ocular health. [24]

3. Discussion

Results of above study suggest that simple relaxation techniques like *Yoga* and various eye relaxation techniques improves fine motor skills. Eye exercises have a great role to play in asthenopic features.

The sense organ, which is misused to the maximum extent, is eye, that is, *Mithya* or *Atiyoga* of *Chaksurendriya*. In this era of changed life style and increased pace, it is the primary duty of the *Ayurvedic* community to educate the society regarding the healthy use of this sense organ. A regular schedule in this regard for the prompt relaxation of the eye is not only beneficial to such refractive problems but also can prevent many degenerative conditions. A schedule of optimum exercise improves *Rasa*, and *Rakta Samvahana* as well as improves the efficacy of sense organs in their perception. A mild derangement of these *Dhatus* can completely be cured with these exercises. If the vitiation is moderate to severe, this can very well act as suitable supportive therapy. [25]

According to *Atharava Veda*, the functioning office of the *Vata* is the brain and it facilitates all organs for their proper function. [26] *Acharya Charaka* states that *Vata* in its normal state of functioning sustains all the organs of the body and prompts all types of actions. It restrains and impels mental activities, coordinates all the sense faculties and helps in the enjoyment of their objects. [27] All senses are controlled by *Mana* (mind) and *Vata* controls the *Mana* (mind). [28] Thus, for the proper functioning of the senses, the functional equilibrium between *Vata* and *Mana* (mind) is needed. *Vitiated Vata Dosha* perturbs the mind and leads to the condition in which impairment of vision occurs (*Sarvendriyani Uphanti*). [29] Eye being the sense organ closely associated to the mind [30] which might have influenced for better outcome in *Yoga* treated group as the concentration and the relaxation probably mitigate the provoked *Vata* and *Kapha* by channelizing *Vata* in its normal path and *Kapha* by *Sroto Shodhana* effect. *Yoga* has the ultimate target to make the mind stable through *Vayu Nigraha*. [31] *Pranayama* established the equilibrium between positive and negative currents and due to the deep penetration of *Prana*, the blood receives a larger supply of oxygen. *Pranayam* is considered to have the capacity to alter autonomic activity. Slow and deep breathing itself has a calming effect on the mind and helps an individual to de-stress. This calming effect may also exert a profound physiological effect on the mental functions of the brain. [32] As myopia is mentioned a *Tridoshaja Vyadhi*, *Pranayama* soothes the eyes and cures the *Kapha Pitta Vikaras*. [33]

Where as in *Trataka Yoga Kriya*, imagination power increases, and functional efficiency of extraocular and intraocular increases by forcing them to work and enhancing the metabolism of rods and cones through the mechanism of dark and light adaptation. Its most important effect is on *Agya Chakra* and the brain.

Neti destroys all diseases that manifest above the throat (*Urdhvajatrugata*), reduces *Kapha Dosha*, has a relaxing and irrigating effect on the eyes and gives divine sight. [34] *Yogi Swatmarma* states that *Neti* affects the psychic center known as *Agya Chakra* which helps in awakening higher states of meditation. [35] The two main nerves in the nose are the olfactory and the fifth cranial (facial sense perception), these are stimulated by the passage of water during *Neti* and send nerve impulses directly to the brain. This leads to the stimulation of other nerve connections in the brain. Eventually, motor and autonomic nerve fibers are fired at the end of the nerve pathways and different parts of the brain are stimulated. The health and optimal function of the body and mind is enhanced through the powerful autonomic nervous influence of *Pranayama* and *Neti Kriya*.

In a nutshell, we can say that *Yogasana* related to *Annamaya Kosh*, *Vijnanamaya Kosha* and *Manomaya Kosh* like *Neti*, *Trataka*, *Pranayama* and ocular exercises, stimulate the *Chakshu Nadi* and *Agya Chakra*. That leads to stimulation of vision, improvement in stretchability and power of extraocular. All these effects improve the power of refractive errors.

4. Conclusion

Refractive errors are one of the serious diseases of visual impairment. Ocular exercise and *Yoga* practices were found to be improving eyesight. It can be concluded from above that these *Yoga* practices and ocular exercises should be applied in our daily lives not only to correct refractive errors but also to enhance good vision.

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