

Effect of Yoga-Based Ocular Exercises in Lowering of Intraocular Pressure in Glaucoma Patients: An Affirmative Proposition

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Abstract

Glaucoma is the most common cause of irreversible blindness worldwide, with >65 million sufferers. It is incurable and the only therapeutic approach accepted till now is the lowering of intraocular pressure (IOP) medically and/or surgically. These known interventions might have many side effects and complications. Yoga-based interventions are now well accepted as alternative therapy in many chronic diseases. The effects of yoga in glaucoma, however, have not been studied adequately. Accommodation (the process of adjustment of optical power to maintain clear vision) of eyes leads to instant lowering of IOP. Therefore, we hypothesize that one of the yoga-based interventions, *Tratak kriya*, which includes ocular exercises might lead to lowering of IOP in glaucoma patients. The proposed *Tratak kriya* leads to contraction and relaxation of ciliary muscles which might increase outflow of aqueous humor. In addition, this yoga-based intervention might decrease stress and improve quality of life in glaucoma patients.

Keywords: *Glaucoma, intraocular pressure, Tratak kriya, yoga*

Introduction

Glaucoma is an, as of now, incurable irreversibly blinding disorder. Frequent follow-ups and repetitive monitoring is needed to slow down the progression of this disorder. The treatment includes a group of medicines such as prostaglandin (PG) analogs and surgical procedures such as trabeculectomy which might have inevitable side effects. Therefore, there is a need for evaluating the effectiveness of nonpharmacological, yoga-based ocular exercises in glaucoma patients. These ocular exercises, *Tratak kriya*, involve accommodation and de-accommodation of the eyes by contraction and relaxation of ciliary muscles. The ciliary muscles are supportive to preserve normal intraocular pressure (IOP) by modifying outflow of the aqueous humor. By reducing IOP, it might slow down the progression of glaucoma and might be helpful in the prevention of the onset of this disorder in high-risk individuals. Here, we present the basic information on accommodation of eyes, presbyopia, ciliary muscle functions, glaucoma, and *Tratak kriya* followed by our hypothesis.

Eye accommodation, presbyopia, and ciliary muscle

Eye accommodation is a unique feature of our visual system which allows us to focus on object(s) of interest, placed at varied distances. The mechanism of accommodation and its loss with aging is still controversial.[1] Maximum distance from which an object can form a clear image on retina is known as far point of accommodation, while the minimum distance where an object can form a single clear image on retina is termed as near point of accommodation. Far point is considered to be infinity and the near point is as close as 6.5 cm from eyes. During near-point accommodation, the ciliary muscles contract and during far-point accommodation ciliary muscles relax.[2] The ability to accommodate may change physiologically with aging (presbyopia), or pathologically as in cataract. Although ciliary muscles play a major role in accommodation, the loss of accommodation in presbyopia is mainly attributed to the hardening of the crystalline lens (lenticular-based theories of presbyopia). Presbyopia affects almost all individuals by the age of 45–50 years due to changes in the lens, along with decreased functionality of ciliary muscles, but significant function of ciliary muscle is retained even till the late presbyopic ages.[3] One study reported that the human ciliary muscle might retain its ability to contract throughout the life span. The eye accommodation is possible in older age even after intraocular lens (IOL) implantation in postcataract surgery patients,[2] the pseudophakic (with artificial IOL) eye(s) react similarly when compared to the phakic accommodating eyes of young individuals. Since ciliary muscles hold an important role in both the accommodation of eyes and controlling the aqueous outflow,[4] there is a possibility that presbyopia might be linked to the development of glaucoma.[4]

Glaucoma

Glaucoma may be defined as a group of diseases that damage the eye's optic nerve (especially retinal ganglion cells [RGCs]) and can result in vision loss and irreversible blindness. It is often, but not always, associated with raised IOP. The raised IOP is a major risk factor which leads to damage of RGCs. Glaucoma has been positively correlated with stress, family history, diabetes, hypertension, obesity, high myopia, etc., but whether some of the factors such as high myopia and stress are the risk factors or outcome of raised IOP is still debated.

Mismatch between aqueous humor production and its outflow, primarily due to increased aqueous outflow resistance, leads to elevated IOP. Although mechanisms and regulation of aqueous outflow resistance are not fully understood, nonetheless, it is well accepted that IOP is the only alterable variable in glaucoma.[5] Thereby, reducing IOP by medical, and/or surgical means, with repeated follow-ups, forms the primary goal in the management of glaucoma.

Parasympathomimetic agents such as pilocarpine and PG analogs such as latanoprost are among very potent drugs that are used for the management of glaucoma. While PG analogs tend to increase the uveoscleral outflow by relaxation of ciliary muscles, the parasympathomimetic agents increase the trabecular outflow by contraction of ciliary muscles.[6,7,8,9] However, there might be unavoidable side effects associated with medical as well as surgical treatments of glaucoma. This makes us to look for a more tolerable and affordable therapy which might be easy to follow with minimal side effects on patient's routine activities. Here, we propose a hypothesis that yoga-based ocular exercise, a nonpharmacological parasympathomimetic intervention, might be effective in decreasing IOP in glaucoma, which may be tested scientifically.

Yoga-based ocular exercise

The effects of some *yogasanas* have been observed in glaucoma patients in a few available studies. However, the investigators mostly included *sirsasana* (inverted head pose) as part of their intervention in these studies, while one study tried to observe the effects of ocular exercise on IOP in normal healthy individuals.[10] It is obvious that there is a paucity of scientific literature to analyze the effects

of yoga-based ocular exercises in patients with glaucoma. In the last few decades, yoga-based interventions (including yogic breathing) have shown very promising results in many diseases such as asthma, hypertension, diabetes, obesity, psychological and oxidative stress, cardiovascular diseases, anxiety, arthritis, chronic fatigue syndrome, and even aging. A form of yogic breathing called forced unilateral nostril breathing has been observed to affect the IOP of glaucoma patients significantly. In a study, the forced right nostril breathing led to increased IOP by <5%, while forced left nostril breathing led to reduction in IOP by 25%.[\[11\]](#)

Ancient science of health *Ayurveda* mentions *Tratak kriya* as a technique helpful in maintaining ocular health.[\[12\]](#) A classic 15th-century Sanskrit manual on yoga, *Hatha Yoga Pradipika*, mentions *Tratak* as, “Being calm, one should gaze steadily at a small mark, till eyes are filled with tears. This is called *Trataka* by âchâryas. Trâtaka destroys the eye diseases and removes sloth, etc.”[\[5\]](#) Another Sanskrit manual *Gheranda Samhita* explains *Tratak* as, “Gaze steadily without winking at any small object, until tears begin to flow.” There is some yogic literatures which explicate the use of ocular exercises, especially *Tratak*, claiming to be effective in many eye diseases but have never been tested scientifically in view of evidence-based medicine.[\[12\]](#)

Yogic principles of *Tratak* require continuous staring of any small object (like the flame of a candle) placed at a few feet away from eyes or a distant tree, star, moon, or sun for as long as possible or until watering of eyes starts. Here, we propose a *Tratak kriya* for testing its effectiveness in reducing IOP as well as stress and improving quality of life (QoL) in glaucoma patients.

Hypothesis

The yoga-based *Tratak kriya* leads to contraction and relaxation of ciliary muscles leading to increased outflow of aqueous humor, thus lowering the IOP in glaucoma patients. Studies like a single-blind randomized study which found significant reduction in IOP of glaucoma patients after 10 min of reading books as compared to those with gaze fixed at a point 6 m away[\[13\]](#) suggest that whenever contraction in ciliary muscle is induced by near accommodation of eyes or by drugs, the pore size in the trabecular meshwork increases which may increase the outflow.[\[6,7,13\]](#) During far accommodation, the ciliary muscles relax, decreasing the trabecular meshwork's pore size, whereas it increases the uveoscleral outflow as the humor crosses between the epithelium's devoid surface of ciliary muscle fibers.[\[6,7,8,14,15\]](#) Therefore, *Tratak kriya* might reduce IOP in glaucoma by increasing the outflow through both trabecular and uveoscleral pathways. Practicing controlled yogic breathing causes increased self-awareness and relaxes mind which might lead to decreased stress. Reduced IOP and stress might improve QoL of glaucoma patients.

Croft *et al.* (2017) suggested that restoring ciliary muscle movement might inhibit the inception or progression of glaucomatous optic neuropathy, independent of their effects on the outflow pathways.[\[4\]](#) Based on the available experimental data and literature, we hypothesize that this yoga-based *Tratak kriya* might lower down the IOP as well as stress and improve QoL in glaucoma patients.

Evaluation of the hypothesis

We propose the following approaches to test our hypothesis:

1. After preparing a detailed protocol of yoga-based *Tratak kriya*, it might be taught to and practiced by patients with glaucoma under supervision; every day for a specified duration
2. Enrolling patients after appropriate screening to select those who shall be able to practice the ocular exercises for the specified duration and excluding patients with cataract or vision <6/60
3. Monitoring various confounding factors which might affect the outcome of intervention on IOP such as stress, high blood pressure, blood sugar, obesity, and visual acuity (high myopia)

4. Recording the IOP daily in both eyes before and after the intervention
5. Once the intervention has been tested provisionally, it may be validated further in two groups of patients with glaucoma: first group, standard medical treatment with “add-on” this proposed intervention versus second group, with standard medical treatment alone (an effective randomized controlled trial)
6. As a preventive approach, the same intervention might also be tested on nonglaucomatous healthy individuals with normal IOP to observe if the intervention would reduce the IOP in high-risk apparently healthy individuals and this might be helpful in the prevention of glaucoma.

Discussion

Glaucoma management includes medical and/or surgical interventions which have various side effects and complications. Here, we propose a relatively safe nonpharmacological intervention—Yoga-based *Tratak* ocular exercise—as an add-on, or alternative therapy for patients with glaucoma. One of the possible challenges to test this hypothesis might be the compliance of patients during the follow-ups and enrolling healthy individuals without any IOP abnormality to participate in the study.

Conclusion

Cumulatively, aforementioned evidence from various studies support that yoga-based *Tratak* ocular exercise might lead to decrease in IOP in glaucoma patients and might halt further damage of RGCs. In addition, this intervention might be useful in prevention of the onset of glaucoma in high-risk individuals. Multiple studies are needed to validate this hypothesis as an alternative therapy for the management of glaucoma.

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Conflicts of interest

There are no conflicts of interest.

References

1. Özyol E, Özyol P. Evaluating relaxed ciliary muscle tone in presbyopic eyes. *Graefes Arch Clin Exp Ophthalmol*. 2017;255:973–8. [[PubMed](#)] [[Google Scholar](#)]
2. Glasser A. Accommodation: Mechanism and measurement. *Ophthalmol Clin North Am*. 2006;19:1–12. [[PubMed](#)] [[Google Scholar](#)]
3. Tabernero J, Chirre E, Hervella L, Prieto P, Artal P. The accommodative ciliary muscle function is preserved in older humans. *Sci Rep*. 2016;6:25551. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
4. Croft MA, Lütjen-Drecoll E, Kaufman PL. Age-related posterior ciliary muscle restriction – A link between trabecular meshwork and optic nerve head pathophysiology. *Exp Eye Res*. 2017;158:187–9. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
5. Allingham RR. *Shields' Textbook of Glaucoma*. 6th ed. Philadelphia: Lippincott Williams and Wilkins; 2010. p. 656. [[Google Scholar](#)]
6. Lütjen-Drecoll E. Functional morphology of the trabecular meshwork in primate eyes. *Prog Retin Eye Res*. 1999;18:91–119. [[PubMed](#)] [[Google Scholar](#)]

7. Overby DR, Bertrand J, Schicht M, Paulsen F, Stamer WD, Lütjen-Drecoll E, et al. The structure of the trabecular meshwork, its connections to the ciliary muscle, and the effect of pilocarpine on outflow facility in mice. *Invest Ophthalmol Vis Sci.* 2014;55:3727–36. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
8. Kaufman PL. Enhancing trabecular outflow by disrupting the actin cytoskeleton, increasing uveoscleral outflow with prostaglandins, and understanding the pathophysiology of presbyopia interrogating mother nature: Asking why, asking how, recognizing the signs, following the trail. *Exp Eye Res.* 2008;86:3–17. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
9. Li G, Farsiu S, Chiu SJ, Gonzalez P, Lütjen-Drecoll E, Overby DR, et al. Pilocarpine-induced dilation of Schlemm's canal and prevention of lumen collapse at elevated intraocular pressures in living mice visualized by OCT. *Invest Ophthalmol Vis Sci.* 2014;55:3737–46. [[PMC free article](#)] [[PubMed](#)] [[Google Scholar](#)]
10. Dimitrova G, Trencева A. The short-term effect of yoga ocular exercise on intra-ocular pressure. *Acta Ophthalmol.* 2017;95:e81–2. [[PubMed](#)] [[Google Scholar](#)]
11. Backon J, Matamoros N, Ticho U. Changes in intraocular pressure induced by differential forced unilateral nostril breathing, a technique that affects both brain hemisphericity and autonomic activity. A pilot study. *Graefes Arch Clin Exp Ophthalmol.* 1989;227:575–7. [[PubMed](#)] [[Google Scholar](#)]
12. Patwardhan SD, Shah B, Sharma P, Menon V, Saxena R. Convergence insufficiency. *Delhi Ophthalmol Soc.* 2009;20:23. [[Google Scholar](#)]
13. Cassidy L, Delaney Y, Fitzpatrick P, Blake J. Effect of accommodation on intraocular pressure in glaucomatous eyes. *Ir J Med Sci.* 1998;167:17–8. [[PubMed](#)] [[Google Scholar](#)]
14. Payne S. Ciliary Muscle. [Last accessed on 2015 Dec 11]. Available from: <http://www.theinfolist.com/php/SummaryGet.php?FindGo=Ciliary%20muscle> .
15. Eva P, Whitcher J. Vaughan & Asbury's General Ophthalmology. 17th ed. McGraw Hill: Blackwell Publishing Asia; 2008. p. 465. [[Google Scholar](#)]

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