

Effect of Yoga and Physical exercise in Ophthalmology

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Received: 29.01.2023 Revised: 10.02.2023

Introduction:

Yoga is a branch of an ancient Indian science which involves the practice of various specific body postures, body cleansing, and meditation, improving balance, concentration, and alertness of mind and soul.^[1] The Associated Chambers of Commerce and Industry of India (ASSOCHAM), suggests that there has been a spurt in the number of people that have taken up yoga by up to 30% in the past year in India.^[2] In addition, as of 2015, the number of people practicing yoga in the U.S. alone projects at around 36.7 million and is expected to reach over 55 million by 2020.^[3] Therefore, the practice of yoga is becoming widely popular in Western societies as well.

In today's dynamic world, the need of prolonged computer and gazette-related works and reading books has drastically increased. According to the American Optometric Association, the most common symptoms associated with DES are eyestrain, headaches, blurred vision, dry eyes and pain in the neck and shoulders.^[20]

It demands excessive working of the extraocular muscles (EOMs) (vergence)

and ciliary muscles (accommodation) which may cause eye fatigue which in turn may cause other associated asthenopic symptoms.^[4] Yoga practices have shown to be associated with physical as well as mental health benefits through downregulation of the hypothalamic-pituitary-adrenal axis and the sympathetic nervous system.^[5] Also, studies have suggested that yoga eye exercises are believed to improve ocular motility and relieves symptoms of asthenopia and eye fatigue.^[6,7]

Yoga ocular exercises are recommended by yoga practitioners in order to maintain normal eye health and well-being. It is seen that there is a significant decrease in the IOP after a short-term practice of yoga ocular exercises for about 5 min.^[8] However some of the yoga positions may be regarded as isometric exercises and may involve body inversion, which was found to have a severe impact on IOP.^[9]

A study also indicates that IOP decreased, whereas average retinal thickness of the

macula increased after yoga exercises for eyes.^[24,31]

Physical activity was reported to have beneficial effects on some of the major causes of blindness, such as glaucoma,^[26] age-related macular degeneration,^[27] and diabetic retinopathy.^[28]

The health benefits of regular physical activity are well established due to its protective influence against obesity, type 2 diabetes, elevated blood pressure, inflammation, coronary heart disease events, and all-cause mortality risk.^[11]

Exercise, such as jogging and cycling, was reported to affect both IOP^[29] and ocular hemodynamic parameters.^[30] A large section of patients have shown better ocular physiological functions due to sports and hence can be considered essential for preventing common ocular disorders. Given that some of these vascular risk factors (e.g., obesity and inflammation) are also postulated to have a role in the pathogenesis of AMD (age-related macular degeneration)^[12], there is a substantial potential for physical activity to modify the risk of AMD developing in the longer term. Regular exercise reduces macular degeneration risk, according to a study in the British Journal of Ophthalmology. Researchers found that people who led an active lifestyle were 70 percent less likely to have AMD develop during the follow-up period.^[33] Although moderate exercise is considered beneficial in patients with glaucoma, specific physical exercises such as headstand, weight lifting, squats, wearing of goggles during swimming, etc., were reported to transiently increase IOP.^[25]

Discussion

Yoga is an ancient form of exercise that focuses on strength, flexibility, and breathing, to promote physical and mental

well-being. Yoga has been found to be beneficial in various conditions and can reduce cardiovascular risk and improve general mental well-being.^[21] Many ocular effects associated with physical exercises have been observed. The most commonly described effects are those associated with IOP level changes, ocular perfusion pressure (OPP), ocular blood flow (OBF), choroid blood flow, and myopic shift.^[22] Physical exercises increase perfusion pressure up to 190% baseline and also increase choroidal blood flow up to 140%, thus providing more blood to retina.^[22]

A recent review on glaucoma, IOP and ocular blood flow during isometric and dynamic exercise showed that isometric exercise causes acute IOP reduction, but such a reduction is more significant during dynamic exercise. The physiological mechanisms that explain this phenomenon remain unknown and have not been sufficiently studied, but there is a consensus that decreased pH, increased plasma osmolality, and increased blood lactate are the primary factors for IOP reduction due to exercise^[11]. In aerobic exercise, IOP reduction is proportional to exercise intensity but it is not related to volume (the duration of an exercise session). Therefore, both in physically active and sedentary individuals IOP declines more sharply during aerobic than anaerobic activities.^[10] In one study, aerobic exercise (such as walking, swimming, biking, or working out on stationary machines) at a brisk level for 30 to 45 minutes three to four times a week lowered intraocular pressure (IOP) and improved blood flow to the brain and the eye.

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. The staring continuously at a small object such as the candle flame that is placed at a few feet away from eyes or a distant object grounds to alternate relaxation and contraction of ciliary muscles of eye. In glaucoma patients, this effect results in improved outflow of aqueous humor reducing the IOP.^[32]

Nitin Gosewade *et al.* (2013) concluded that eye exercises showed improvement in visual reaction time (VRT).^[16] The study suggested that short term interventions like pranayama and eye exercises relieve strain on the eyes and also refresh the mind reflected by improvement in the VRT. Kapalbhathi improves the oxygenation of blood in the body which helps in better nourishment of all the structures of eyeball along with nerves. It has been reported that yoga practice results in a decrease in mental fatigability and an increase in performance quotient and makes a person psychologically more stable and competent.

Nitin Gosewade *et al.* (2015) suggested that practice of pranayama along with eye exercises for 8 weeks improves the visual acuity.^[15] In contrast, the control group subjects who had not practiced pranayama do not show any improvement in the visual acuity. Therefore pranayama along with eye exercises can be used as potential non-pharmacological measure for visual acuity improvement.

In the study conducted by Kim S-D, after 8 weeks of yogic eye exercises, the eye fatigue scores significantly decreased compared with those obtained before starting yoga practice. Also, nursing students in the yoga exercise group had a significant decrease in their eye-fatigue

levels over the 8-week period, while those in the control group had no difference in their eye-fatigue levels.^[6]

Physical exercise play an important role in maintaining normal physiological functions of the eye. In general, it decreases IOP(intraocular pressure) and increases OPP(ocular perfusion pressure). Outdoor exercises enable in reducing the incidences of myopia and also slows down its progression. Physical activity helps to prevent AMD, glaucoma as well as cataract. Although physicians should not recommend physical exercises such as isometric exercises, swimming with swimming goggles, and exercises with Valsalva maneuver to patients with glaucoma and diabetes mellitus.

Of those that observed a significant association, only CAREDS^[13] and a United States cohort study of runners had accounted for the influence of diet on the relationship between exercise and AMD.^[14] However, the CAREDS examined the relationship in women only and not in men,^[13] and the latter study of runners did not have clinically verified diagnosis of AMD (i.e., only self-reported AMD); therefore, no information was available on the stage of AMD in this cohort.^[14] As AMD is multi factorial, combined therapy with preventive measures, Chakshushya Rasayanas, eye exercises & yoga will be more beneficial than a single drug therapy. Thus we can tackle AMD well by a holistic approach combining ayurveda, eye exercises & yoga.^[33]

On the other hand, yoga has its own risks.

Jessica et al. investigated the IOP changes in four common head-down yoga positions (Fig 1), namely Adho Mukha Svanasana, Uttanasana, Halasana and Viparita Karani , in patients with POAG and in normal subjects and found that all these postures induced an IOP elevation of 16% to 70%

in both patients with POAG and normal subjects, although there was no statistically significant difference in IOP rise in the two groups.^[9] Since elevated IOP is the most important known risk factor for development and progression of glaucomatous optic neuropathy, the rise in IOP after performing these yoga poses is of concern for glaucoma patients. Therefore these head-down postures should be avoided in people at high risk or with glaucoma.

In a recent study, Dr. Ritch and his colleagues had glaucoma patients and a cohort of healthy participants perform a series of four inverted yoga positions—downward-facing dog, standing forward bend, plow, and legs-up-the-wall poses.^[17] The researchers captured the IOP in each group at five time points: 1) at baseline, while seated, 2) immediately after assuming the pose, 3) two minutes later, while still holding the pose, 4) immediately after performing the pose, in a seated position, and 5) 10 minutes later, after resting in the seated position. Both groups of participants showed a rise in IOP in all four yoga positions, with the greatest increase of pressure—almost 10 mm Hg—occurring during downward-facing dog. After a few minutes of rest, all eye pressures returned to normal.

Acute changes in posture, especially between an upright position and a head-down position, may cause acute posterior vitreous detachment. As yoga practitioners may be required to assume the head-down position, also known as "sirsasana," patients with myopia or ocular abnormalities should be warned of the possible ophthalmological complications of this exercise.^[23]

Since raised IOP is the most essential known risk factor for development and progression of glaucomatous optic neuropathy, the rise in IOP after performing the yoga poses is of concern for glaucoma patients. It has remained uncertain whether the concomitant rise in cerebrospinal fluid pressure as the trans-lamina cribrosa counter-pressure against the IOP sufficiently compensates in amount in a timely manner for the rise in IOP.

Retinal vascular occlusions following intense exercise and dehydration are a rare occurrence. In the literature, there are few reports of isolated Central retinal vein occlusion (CRVO) caused by intense exercise.^[18,19]

Exercise may also increase the risk of CRVO. It is believed that exercise of any intensity can alter the rheologic properties of blood.^[19] Therefore, exercise-induced impairment in blood rheology is also considered by some to be a risk factor for vascular thrombotic events, including CRVO. They reported six patients who presented with sudden, painless loss of vision after intense exercise. None of them had any previous medical problems or any identified risk factors for venous occlusive disease. All six were diagnosed with nonischemic CRVO at the time of presentation. All these patients had been exercising intensely before experiencing visual changes. One of the patients was training for a triathlon, two were hiking, one had been mountain biking, and two had been running. CRVO can occur at any age and in patients of all levels of athletic conditioning. Although the exact precipitating event is unknown, it is likely a combination of transiently increased intra-vascular pressure in the retinal microcirculation, dehydration, and hemorheological abnormalities.

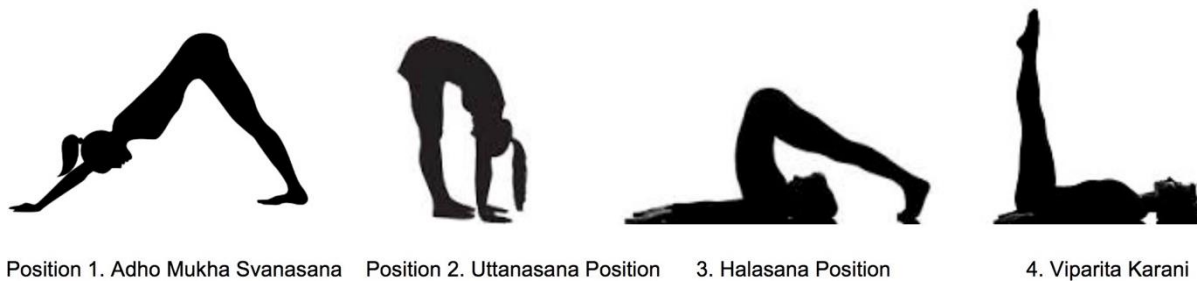


Fig 1. Scheme Illustrating the Various Yoga Positions.

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