

NON IOP Lowering Approaches

By,

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Introduction

- Glaucoma is a major ocular **neurodegenerative** disease characterized by progressive retinal ganglion cells degeneration and sight loss.
- Current treatment options have been **limited to reducing intraocular pressure (IOP)**, known as the leading risk factor for this disease; however, glaucoma can develop even with low or normal IOP and progress despite controlling IOP values.



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- Patients often ask, “**Is there anything else I can do?**”
 - Many patients with glaucoma want to know that they are doing everything possible—even beyond their medical and surgical glaucoma treatments—to avoid progressive vision loss.



Lifestyle

- **Lifestyle, dietary habits, and supplementation** may influence some of the risk factors and pathophysiological mechanisms underlying glaucoma development and progression; thus, the role of this complementary and alternative medicine in glaucoma has received great interest from both patients and ophthalmologists.

- *Fahmideh F et al. Non-drug interventions in glaucoma: Putative roles for lifestyle, diet and nutritional supplements. Survey of ophthalmology 67 (2022) 675–696*



Exercise

- Exercise facilitates IOP reduction in the **immediate post-activity period**; however, the activity's type and intensity affect this lowering. Indeed, both being fit and physically active reduces glaucoma risk.
- Although the exact mechanism is not elucidated, it is suggested to be related to nitric oxide release.
- *Zhu MM, Lai JSM, Choy BNK, et al. Physical exercise and glaucoma: a review on the roles of physical exercise on intraocular pressure control, ocular blood flow regulation, neuroprotection and glaucoma-related mental health. Acta Ophthalmol. 2018;96*



Exercise

- **Weightlifting** may increase IOP modestly during workouts through a Valsalva maneuver mechanism. The clinical significance of this elevation is unclear.
- *Vieira GM, Oliveira HB, de Andrade DT, Bottaro M, Ritch R. Intraocular pressure variation during weight lifting. Arch Ophthalmol. 2006;124(9):1251-1254.*



Exercise

- Yoga has become increasingly popular, and its practice often involves various **head-down** positions that can potentially **double IOP** after a few minutes.
- As such, patients should be counseled to avoid maintaining these positions for sustained periods of time, especially those with progressive or advanced glaucoma.
- *Baskaran M, et al. Intraocular pressure changes and ocular biometry during Sirsasana (headstand posture) in yoga practitioners. Ophthalmology. 2006;113(8):1327-1332*



Sleep

- In treated patients with open-angle glaucoma, while in the **lateral position**, the dependent eye has been shown to have a significant increase in IOP compared with the nondependent eye.
- Patients can be advised to avoid sleeping on the side of the more severely affected eye, especially in cases of highly asymmetric disease.
- *Lee TE, Yoo C, Lin SC, Kim YY. Effect of different head positions in lateral decubitus posture on intraocular pressure in treated patients with open-angle glaucoma. Am J Ophthalmol. 2015;160(5):929-936 e4*



Sleep

- Sleeping in a face-down position has also been shown to increase IOP by approximately 2.5 mm Hg.

- *Flatau A, Solano F, Idrees S, et al. Measured changes in limbal strain during simulated sleep in face down position using an instrumented contact lens in healthy adults and adults with glaucoma. JAMA Ophthalmol. 2016;134(4):375-382.*



Sleep

- The link between **sleep apnea** and glaucoma has been studied but remains **unclear**. Early reports found that untreated sleep apnea carries an increased risk of glaucoma development and progression. However, more recent studies have failed to show a relationship between sleep apnea and progression of glaucoma.

- *Hashim SP, et al. Prevalence of glaucoma in patients with moderate to severe obstructive sleep apnea: ocular morbidity and outcomes in a 3 year follow-up study. Eye (Lond). 2014;28(11):1304-1309.*



Medical Comorbidities

- Asking patients about **antihypertensive** medication dosing in the evening and sleep apnea may also illuminate areas to consider in managing their glaucoma.
- A recent study found that a 10-mm Hg drop in mean arterial pressure during sleep was predictive of visual field progression in patients with normal-tension glaucoma. The study authors suggest that nocturnal blood pressure be considered a modifiable risk factor in these patients.
- *Charlson ME, de Moraes CG, Link A, et al. Nocturnal systemic hypotension increases the risk of glaucoma progression. Ophthalmology. 2014;121(10):2004-2012.*



Diet & Supplements

- Oxidative damage to the trabecular meshwork and free radical reactions with retinal ganglion cells are mechanisms that may suggest a beneficial role of antioxidants in glaucoma. However, in the only prospective study available, **no significant** relationship between glaucoma and intake of carotenoids, vitamin C, and vitamin E was found.
- Summing up, the data present in the literature are **insufficient** to support vitamin administration as a tool that can be used specifically to decrease the risk or treat glaucoma
- *Kang JH, Pasquale LR, Willett W, et al. Antioxidant intake and primary open-angle glaucoma: a prospective study. Am J Epidemiol. 2003;158(4):337-346.*



Diet & Supplements

- Consumption of **omega-3 fatty acids** has been the focus of several glaucoma studies. A 2018 cross-sectional study of 3,865 patients found lower glaucoma risk in those who consumed increased amounts of omega-3 fatty acids.

- Wang YE, Tseng VL, Yu F, Caprioli J, Coleman AL. Association of dietary fatty acid intake with glaucoma in the United States. *JAMA Ophthalmol*. 2018;136(2):141-147.



Diet & Supplements

- Systemic **anti-inflammatory** modulation of omega-3 fatty acid may contribute to the observed IOP-lowering effects possibly through effects on outflow resistance through the trabecular meshwork and/or modulation of uveoscleral outflow.

- Nguyen C, et al. Dietary omega 3 fatty acids decrease intraocular pressure with age by increasing aqueous outflow. *Invest Ophthalmol Vis Sci*. 2007;48:756-762.



Diet & Supplements

- An additional potential benefit is the **neuroprotection** that omega-3 fatty acid intake provides which is beneficial for retinal function, particularly ganglion cell function.
- Omega-3 fatty acids **reduce blood viscosity**, which may yield beneficial effects in terms of modulating optic nerve blood flow.
- *Nguyen C, et al. Dietary omega 3 fatty acids decrease intraocular pressure with age by increasing aqueous outflow. Invest Ophthalmol Vis Sci. 2007;48:756-762.*



Diet & Supplements

- **Ginkgo biloba** extract has been shown to have potential role in glaucoma through **neuroprotective, anti-inflammatory** effects as well as to be able to **increase blood flow** through vasodilation and reduce blood viscosity.
- *Kang JM, Lin S. Ginkgo biloba and its potential role in glaucoma. Curr Opin Ophthalmol. 2018;29(2):116-120*





Gut microbiota & Glaucoma

- Another interesting point to consider is the **gut-eye axis** and its potential impact on ocular disease, especially glaucoma.
- **Alternation of gut microbiota** and derived metabolites may provide new insights into the pathogenesis of glaucoma, and into restoring a normal microenvironment to treat or prevent glaucoma.

Metabolomics in POAG

- Recently, different Studies have performed on the **metabolites in aqueous humor and plasma** of patients with POAG to gain further insights into the pathogenesis of the disease which might have a role in future therapy of POAG.
- These studies concluded that (Metabolomic Profiling of Aqueous Humor and Plasma in Primary Open Angle Glaucoma Patients Points Towards Novel Diagnostic and Therapeutic Strategy).



