

# Mindfulness Meditation Can Benefit Glaucoma Patients

Tanuj Dada<sup>1</sup>, Meghal Gagrani<sup>2</sup>

*Journal of Current Glaucoma Practice* (2019): 10.5005/jp-journals-10078-1239

Glaucoma is a form of neurodegenerative disease characterized by loss of retinal ganglion cells. Glaucomatous damage involves trans-synaptic neurodegeneration affecting the visual pathway including the lateral geniculate nucleus and the occipital cortex.<sup>1</sup>

Various mechanisms<sup>2-6</sup> have been implicated in neuronal apoptosis including barotrauma, hypoxia, glial cell activation, decrease in neurotrophins, central insulin resistance, mitochondrial dysfunction leading to oxidative damage,<sup>2</sup> and glutamate excitotoxicity. In the light of these pathogenetic mechanisms leading to neurodegeneration, glaucoma has been recently labeled as type IV diabetes.<sup>7,3</sup> Raised intraocular pressure is the most frequently implicated risk factor in the progression of glaucoma and is currently the only target for therapeutic interventions.

Glaucoma is associated with a poor quality of life and patients have increased anxiety and depression due to the stress of this blinding disorder. Stress and glaucoma have a two-way relationship, each exacerbating the effect of the other. Stress leads to the release of endogenous cortisol which can lead to an increase in intraocular pressure (IOP) as glaucoma patients are high steroid responders. Like in any other chronic stressful conditions, serum cortisol levels are higher in patients with glaucoma and ocular hypertension. If we can reduce stress, we can reduce levels of endogenous cortisol and thereby potentially reduce IOP.

Various researchers have tried to decipher the role of the brain and use it as a potential therapeutic target in glaucoma.<sup>7</sup> The key question is—Can meditation be used for this purpose?

<sup>1,2</sup>Dr Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences, New Delhi, India

**How to cite this article:** Dada T, Gagrani M. Mindfulness Meditation Can Benefit Glaucoma Patients *J Curr Glaucoma Pract* 2019; 13(1):1–2.

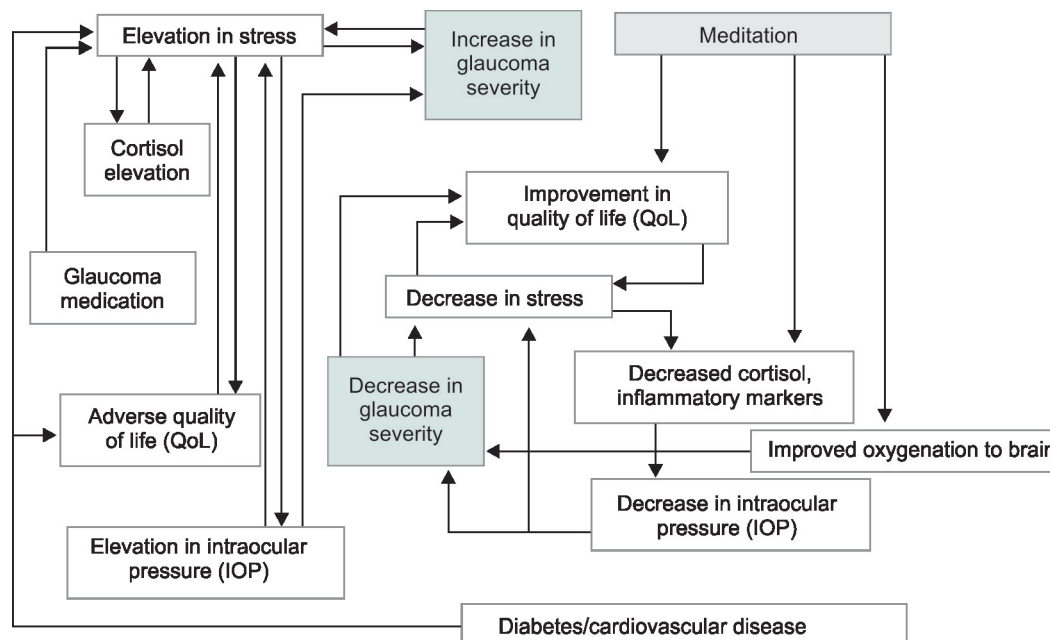
**Source of support:** Nil

**Conflict of interest:** None

Meditation refers to a family of self-regulation practices that focus on training attention and awareness to bring mental processes under greater voluntary control and thereby foster general mental well-being and development and/or specific capacities such as calm, clarity, and concentration.<sup>8</sup> During meditation, attention can be focused on a mantra, sound, or breath. Mindfulness meditation focused on the breath has an additional benefit as slow breathing activates the parasympathetic nervous system and counters the stress response.

The practice of meditation has not only been associated with electroencephalographic changes but also significant structural changes in the brain.<sup>9</sup> Increased structural connectivity<sup>10</sup> and white matter changes accounting for the neuroplasticity have been found in long-term meditators. Long-term meditators have been found to increase cortical thickness in the prefrontal cortex, anterior insula, thalamus, and hippocampus.<sup>11,12</sup> Additionally, short-term

**Flowchart 1:** Impact of meditation in glaucoma patients



meditation has also shown to induce white matter changes in the cingulate cortex.<sup>13</sup> These changes provide evidence of cortical plasticity associated with meditation, occurring by changes in myelin density, axonal membrane integrity, axonal density, etc.<sup>14</sup>

Meditation has been found to improve the quality of life and decrease stress in various chronic diseases like diabetes, hypertension, major depression, and cancers. This stress reduction has also been associated with a reduction in the risk of mortality in cardiovascular disease.<sup>15</sup> Meditation has been associated with a reduction in serum cortisol levels and plasma catecholamines.<sup>16,17</sup> Additionally, it causes downregulation of proinflammatory gene expression and decreases oxidative stress with an improvement in mitochondrial function.<sup>18,19</sup>

How can meditation benefit patients with glaucoma? A short-term course of mindfulness meditation was found to reduce IOP, reduce stress biomarkers, and positively modulate gene expression with an improvement in the quality of life in patients with glaucoma.<sup>20</sup> Additionally, a short-term course of meditation was found to improve the cerebral oxygenation of the prefrontal cortex in glaucoma patients using functional near-infrared spectroscopy,<sup>21</sup> with an increase in brain-derived neurotrophic factor, suggesting a possible role in preventing retinal ganglion cell death.<sup>21</sup>

Another aspect of glaucoma which is often neglected is the caregiver burden. A significant burden of emotional and psychosocial stress is present in caregivers of glaucoma patients and caregivers also suffer from greater emotional and physical disorders as compared to noncaregivers. Meditation has been suggested as an effective strategy for stress reduction in caregivers also.<sup>22-24</sup>

In conclusion, meditation can positively modulate cellular pathways (Flowchart 1) involved in glaucoma pathogenesis leading to a significant reduction in IOP and improve the quality of life of glaucoma patients. It is a technique which involves a low risk and low cost and can be universally done by glaucoma patients, even if elderly or bedridden and can serve as a useful adjunct to standard ocular hypotensive therapy for glaucoma patients.

## REFERENCES

- Rokicki W, Dorecka M, et al. Retinal ganglion cells death in glaucoma—mechanism and potential treatment. Part II. *Klin Oczna* 2007;109(7–9): 353–355.
- Chrysostomou V, Reznia F, et al. Oxidative stress and mitochondrial dysfunction in glaucoma. *Curr Opin Pharmacol* 2013 Feb;13(1):12–15. DOI: 10.1016/j.coph.2012.09.008.
- Faiq MA, Dada T. Diabetes type 4: a paradigm shift in the understanding of glaucoma, the brain specific diabetes and the candidature of insulin as a therapeutic agent. *Curr Mol Med* 2017;17(1):46–59. DOI: 10.2174/1566524017666170206153415.
- Harris A, Siesky B, et al. Cerebral blood flow in glaucoma patients. *J Glaucoma* 2013 Jul;22(Suppl 5):S46–S48. DOI: 10.1097/IJG.0b013e3182934b6b.
- Siesky BA, Harris A, et al. Ocular blood flow autoregulation compromised in glaucoma patients with diabetes. *Invest Ophthalmol Vis Sci* 2014 Apr 30;55(13):2944.
- Nakazawa T. Ocular blood flow and influencing factors for glaucoma. *Asia Pac J Ophthalmol (Phila)* 2016 Feb;5(1):38–44. DOI: 10.1097/APO.0000000000000183.
- Faiq MA, Dada R, et al. Brain: The Potential Diagnostic and Therapeutic Target for Glaucoma. *CNS Neurol Disord Drug Targets* 2016;15(7):839–844.
- Walsh R, Shapiro SL. The meeting of meditative disciplines and Western psychology: a mutually enriching dialogue. *Am Psychol* 2006 Apr;61(3):227–239. DOI: 10.1037/0003-066X.61.3.227.
- Aftanas LI, Golosheikine SA. Human anterior and frontal midline theta and lower alpha reflect emotionally positive state and internalized attention: high-resolution EEG investigation of meditation. *Neurosci Lett* 2001 Sep 7;310(1):57–60. DOI: 10.1016/S0304-3940(01)02094-8.
- Luders E, Clark K, et al. Enhanced brain connectivity in long-term meditation practitioners. *Neuroimage* 2011 Aug 15;57(4):1308–1316. DOI: 10.1016/j.neuroimage.2011.05.075.
- Lazar SW, Kerr CE, et al. Meditation experience is associated with increased cortical thickness. *Neuroreport* 2005 Nov 28;16(17): 1893–1897.
- Luders E, Toga AW, et al. The underlying anatomical correlates of long-term meditation: larger hippocampal and frontal volumes of gray matter. *Neuroimage* 2009 Apr 15;45(3):672–678.
- Tang Y-Y, Lu Q, et al. Short-term meditation induces white matter changes in the anterior cingulate. *Proc Natl Acad Sci U S A* 2010 Aug 31;107(35):15649–15652. DOI: 10.1073/pnas.1011043107.
- Tang Y-Y, Lu Q, et al. Mechanisms of white matter changes induced by meditation. *Proc Natl Acad Sci U S A* 2012 Jun 26;109(26):10570–10574.
- Schneider RH, Grim CE, et al. Stress reduction in the secondary prevention of cardiovascular disease: randomized, controlled trial of transcendental meditation and health education in Blacks. *Circ Cardiovasc Qual Outcomes* 2012 Nov;5(6):750–758. DOI: 10.1161/CIRCOUTCOMES.112.967406.
- Jung Y-H, Kang D-H, et al. The effects of mind-body training on stress reduction, positive affect, and plasma catecholamines. *Neurosci Lett* 2010 Jul 26;479(2):138–142. DOI: 10.1016/j.neulet.2010.05.048.
- Turakitwanakan W, Mekseepalard C, et al. Effects of mindfulness meditation on serum cortisol of medical students. *J Med Assoc Thai* 2013 Jan;96(Suppl 1):S90–S95.
- Creswell JD, Irwin MR, et al. Mindfulness-based stress reduction training reduces loneliness and pro-inflammatory gene expression in older adults: a small randomized controlled trial. *Brain Behav Immun* 2012 Oct;26(7):1095–1101. DOI: 10.1016/j.bbi.2012.07.006.
- Kaliman P, Alvarez-López MJ, et al. Rapid changes in histone deacetylases and inflammatory gene expression in expert meditators. *Psychoneuroendocrinology* 2014 Feb;40:96–107. DOI: 10.1016/j.psyneuen.2013.11.004.
- Dada T, Mittal D, et al. Mindfulness meditation reduces intraocular pressure, lowers stress biomarkers and modulates gene expression in glaucoma: a randomized controlled trial. *J Glaucoma* 2018 Dec;27(12):1061–1067. DOI: 10.1097/IJG.0000000000001088.
- Gagrani M, Faiq MA, et al. Meditation enhances brain oxygenation, upregulates BDNF and improves quality of life in patients with primary open angle glaucoma: a randomized controlled trial. *Restor Neurol Neurosci* 2018 Oct 29;36(6):741–753. DOI: 10.3233/RNN-180857.
- Dada T, Aggarwal A, et al. Caregiver burden assessment in primary congenital glaucoma. *Eur J Ophthalmol* 2013 Jun;23(3):324–328. DOI: 10.5301/ejo.5000238.
- Lavretsky H, Epel ES, et al. A pilot study of yogic meditation for family dementia caregivers with depressive symptoms: effects on mental health, cognition, and telomerase activity. *Int J Geriatr Psychiatry* 2013 Jan;28(1):57–65. DOI: 10.1002/gps.3790.
- Dharmawardene M, Givens J, et al. A systematic review and meta-analysis of meditative interventions for informal caregivers and health professionals. *BMJ Support Palliat Care* 2016 Jun;6(2):160–169. DOI: 10.1136/bmjspcare-2014-000819.