

# Can Melatonin Impact Your Eye Health?

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✓ Fact Checked

March 30, 2023

## STORY AT-A-GLANCE

- › Patients with glaucoma who took melatonin supplements had decreased intraocular pressure
- › Melatonin also helps to restore disrupted circadian rhythms in people with glaucoma
- › Melatonin counteracts oxidative damage in the lens and may be a “potential therapeutic agent for cataract prevention/management”
- › Melatonin may also be useful for neurovascular age-related macular degeneration (AMD) and dry AMD
- › Melatonin also has antiviral, antiaging, anticancer, immunomodulatory and anti-inflammatory effects

Melatonin, well-known for its role in regulating your body’s circadian rhythm, is useful for far more than a good night’s sleep. This hormone was recently heralded for its role in eye health, and it may be an important compound for warding off age-related declines in vision.

Glaucoma, for instance, is among the leading causes of blindness, affecting 70 million people throughout the world. While its underlying causes are unknown, mechanical stress caused by elevated intraocular pressure (IOP) is known to damage retinal ganglion cells.

It's been suggested that glaucoma is, in fact, a neurodegenerative disease, and damage to retinal ganglion cells affects not only vision but also circadian rhythms and sleep. People with glaucoma may have disrupted circadian rhythms compared to their peers,<sup>1</sup> and neuroprotective strategies that prevent damage to retinal ganglion cells could help with both this and glaucoma. In this regard, melatonin checks all the boxes.

## Melatonin Improves Intraocular Pressure

In a study published in the Journal of Pineal Research, a team of scientists investigated the effects of melatonin supplements on patients with glaucoma.<sup>2</sup> Subjects took melatonin daily at 10:30 p.m. for 90 days, experiencing a number of benefits, including:<sup>3</sup>

- Increased stability of systemic circadian rhythm via improved phase alignment and alignment with intraocular pressure
- Decreased intraocular pressure
- Improved function of retinal ganglion cells in those with advanced glaucoma
- Improvements to sleep and mood, particularly in those with advanced glaucoma

Previous research by the team found that melatonin was beneficial for disrupted systemic circadian rhythms and the cardiovascular system.<sup>4</sup> They explained:<sup>5</sup>

*"Being a principal chemical factor for sensing environmental light signaling and synchronizing peripheral clocks, melatonin serves both input and output of the circadian system. Melatonin is regarded as a promising substance to ameliorate complex glaucoma-associated conditions of compromised well-being (i.e., disrupted circadian rhythms, altered sleep and mood).*

*... Combined, these results provide evidence for melatonin efficiency in restoring disrupted circadian rhythms in glaucoma, with different effects of melatonin on systemic vs. local rhythms, suggesting that a personalized strategy for melatonin administration may further refine its benefits."*

# There Are Melatonin Receptors in Your Eyes

Melatonin is often described as a pineal hormone,<sup>6</sup> but only 5% of your body's melatonin – which is also a potent anticancer agent – is produced in your pineal gland. The other 95% is produced inside your mitochondria – provided you get proper sun exposure, which is intricately involved in melatonin production.<sup>7</sup>

Meanwhile, melatonin receptors exist in several areas of the eyes, including the retina, lens and cornea, “which suggests that cells in these tissues may be targets for melatonin action,” researchers wrote in *Pharmacology & Therapeutics*.<sup>8</sup>

This hints at melatonin's importance for regulating eye processes, particularly when “pressure homeostasis” is involved. Writing in *Progress in Retinal and Eye Research*, scientists with the University Complutense of Madrid, Spain, explained:<sup>9</sup>

*“Glaucoma, the most prevalent eye disease, also known as the silent thief of vision, is a multifactorial pathology that is associated to age and, often, to intraocular hypertension (IOP). Indeed IOP is the only modifiable risk factor and as such medications are available to control it; however, novel medications are sought to minimize undesirable side effects.*

*Melatonin and analogues decrease IOP in both normotensive and hypertensive eyes. Melatonin activates its cognate membrane receptors, MT1 and MT2, which are present in numerous ocular tissues, including the aqueous-humor-producing ciliary processes.*

*Melatonin receptors belong to the superfamily of G-protein-coupled receptors and their activation would lead to different signaling pathways depending on the tissue ... the current work highlights the important role of melatonin and its analogues in the healthy and in the glaucomatous eyes, with special attention to the control of intraocular pressure.”*

Further, the effect of melatonin on intraocular pressure has been known for decades. In 1988, researchers with Oregon Health Sciences University exposed subjects to bright

light, in order to suppress serum melatonin levels, and then supplementing with melatonin to gauge its effect on intraocular pressure.<sup>10</sup> A significant connection was found:<sup>11</sup>

*“Our data suggests that during the period of melatonin’s greatest levels in the serum, IOP is lowest. All subjects had maximum pressures from 4 p.m. to 6 p.m. and most subjects had minimums from 2 a.m. to 5 a.m. In experiment one, bright light suppression of melatonin secretion attenuated the early morning fall IOP. This was statistically significant at suggesting that melatonin is involved in lowering early morning IOP.*

*In experiment one, there was only partial suppression of melatonin production with bright light and consequently there was no significant difference in IOP between subjects exposed to dim light and bright light. However, administering 200 micrograms of melatonin orally caused a significant decrease in IOP. Intraocular pressure remained low for approximately four hours after the last dose.”*

## **Melatonin for Vision Health**

Melatonin appears to have far-reaching effects on eye health, even beyond glaucoma. Cataracts, for instance, are associated with oxidative stress, and research suggests melatonin counteracts oxidative damage in the lens and may be a “potential therapeutic agent for cataract prevention/management.”<sup>12</sup>

Melatonin may also be useful for neurovascular age-related macular degeneration (AMD), which is characterized by abnormal angiogenesis in the retina and leads to severe vision loss in more than 90% of those affected. The compound inhibits endothelial progenitor cell angiogenesis and neovascular AMD.<sup>13</sup> According to a study published in the journal *Cells*:<sup>14</sup>

*“The promotion or inhibition of angiogenesis is part of the homeostatic balance, with positive and negative effects outside the optimum range.*

*Melatonin influences this balance, with evidence from several clinical research investigations demonstrating that this hormone has antiangiogenic effects in cancer and chronic ocular diseases.”*

Animal studies also suggest that melatonin protects the retina in dry AMD, while anecdotal reports suggest “favorable” experiences among adults with AMD who supplemented with melatonin.<sup>15</sup> One study suggested melatonin in a dose of 3 to 20 milligrams at bedtime may be useful for controlling dry AMD.<sup>16</sup>

There’s a mitochondrial component as well, as impaired mitochondrial biogenesis is found in human retinal cells affected by AMD — and melatonin is a potential treatment. Researchers explained in Expert Opinion on Therapeutic Targets:<sup>17</sup>

*“During aging, insufficient free radical scavenger systems, impairment of DNA repair mechanisms and reduction of mitochondrial degradation and turnover contribute to the massive accumulation of ROS [reactive oxygen species] disrupting mitochondrial function. Impaired mitochondrial function leads to the decline in the autophagic capacity and induction of inflammation and apoptosis in human RPE cells affected by AMD.”*

Importantly, they noted, “The effect of melatonin on mitochondrial function results in the reduction of oxidative stress, inflammation and apoptosis in the retina; these findings demonstrate that melatonin has the potential to prevent and treat AMD.”

## **What Else Is Melatonin Good For?**

In the human body — aside from having direct antioxidant effects — melatonin stimulates the synthesis of glutathione and other important antioxidants like superoxide dismutase and catalase.

Melatonin increases glutathione through a genomic effect on the enzyme that regulates the synthesis of gamma glutamylcysteine synthetase, the rate limiting enzyme in glutathione synthesis. Melatonin activates that enzyme.

Glutathione tends to be found in high concentrations in cells, although some is also found in the extracellular space and the mitochondria. Melatonin's antioxidant effects are diverse but include preventing free radical generation by enhancing the efficiency of the electron transport chain so fewer electrons leach onto oxygen molecules to generate super oxide antiradical.

Melatonin also has antiviral and anti-inflammatory effects, and more than 140 scientific studies suggest it's a useful agent for treating SARS-CoV-2, according to research published in Cellular and Molecular Life Sciences.<sup>18</sup>

One reason why melatonin works as an anti-COVID-19 agent is due to its role against sepsis (blood poisoning). Melatonin has prevented death in newborns suffering from severe bacterial sepsis<sup>19</sup> and also appears to reverse septic shock symptoms by:<sup>20</sup>

- Decreasing synthesis of proinflammatory cytokines
- Preventing lipopolysaccharide (LPS)-induced oxidative damage, endotoxemia and metabolic alterations
- Suppressing gene expression of the bad form of nitric oxide, inducible nitric oxide synthase (iNOS)
- Preventing apoptosis (cell death)

Melatonin also plays an important role in cancer prevention, with “significant atoxic, apoptotic, oncostatic, angiogenetic, differentiating and antiproliferative properties against all solid and liquid tumors.”<sup>21</sup>

It exerts “both direct and indirect anticancer effects,”<sup>22</sup> in part due to its antioxidant and immunomodulatory effects. Melatonin is also thought to be important for brain, cardiovascular and gastrointestinal health.<sup>23</sup>

## **How to Optimize Your Melatonin Production**

For certain eye conditions, there may be benefits to supplementing with oral melatonin. However, it's also a good idea to optimize your body's own production, which you can do

naturally. Optimizing melatonin production begins with getting enough bright sunlight during the day since this helps to set your circadian clock.

Aim for at least 15 minutes of sunlight in the morning hours helps to regulate the production of melatonin, dropping it to normal daytime levels, so you feel awake during the day and sleep better at night. Ideally you should have sunlight on your bare skin as that will help the near IR in the sunlight activate your mitochondria to produce melatonin. About 95% of your melatonin is produced this way which is why you want the sunlight on your skin.

As evening approaches and the sun sets, you'll want to avoid artificial lighting. Blue light from electronic screens and LED lights is particularly problematic and inhibits the production of melatonin. If you do need lighting, use incandescent light bulbs, candles or salt lamps.

The blue light from electronic screens can be counteracted by using blue blocking software or wearing blue blocking glasses. You should also sleep in complete darkness at night, as even light that shines through closed eyelids can suppress melatonin.<sup>24</sup> If your bedroom isn't pitch-black at bed time, consider wearing a sleep mask.

Engaging in stress-reducing activities, such as stretching or meditation, before bed may also be useful. This is because the release of melatonin is dependent on the release of another hormone, norepinephrine.

Excess stress, and the resulting release of cortisol, will inhibit the release of norepinephrine and therefore the release of melatonin.<sup>25</sup> So in addition to stress-reduction techniques, try to limit stressful activities — like work projects — in the evening hours.

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