

Glaucoma and Exercise: What to Tell Your Patients

Can I or can't I? Should I or shouldn't I? Ophthalmologists are often asked about the effects of exercise—particularly yoga—on glaucoma. As the science is continuing to unfold, considerable uncertainty remains. But a combination of evidence-based recommendations and common sense can go a long way when talking with glaucoma patients about exercise.

Aerobic Exercise: Definitely

There's no question that aerobic exercise is crucial to overall good health. As for glaucoma, Robert Ritch, MD, at New York Eye & Ear Infirmary of Mount Sinai in New York City, tells his patients, "It's simple. If it's good for your heart, it's good for glaucoma. If it's good for your brain, it's good for glaucoma."

Dr. Ritch advises 45 minutes of aerobic exercise three to four times a week. The research supports this guidance:

- 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.¹
- In a recent study, all measures of physical activity—average steps per day, minutes of basic (nonsedentary) movement, and greater time spent doing moderate-to-vigorous physical

activity—were associated with slower rates of visual field (VF) loss in a treated group of glaucoma patients.

At baseline, participants walked an average of 5,313 steps and averaged 148 minutes of nonsedentary activity and 11 minutes of moderate-to-vigorous activity per day. Each incremental increase in activity was associated with less decline in VF, although the observed effects were small. But significantly boosting those levels each day—walking an additional 5,000 steps, engaging in an additional 2.6 hours of nonsedentary activity, or exercising for 120 minutes at a moderate-to-vigorous level—decreased the average rate of VF loss by approximately 10%.²

- Results of a meta-analysis showed that exercise in sedentary people had a greater IOP lowering effect than it did in people who were already active.³ "It's important for clinicians to tell their patients who are not motivated to exercise that it's actually the patients who have not been active who do the best in terms of lowering eye pressure with exercise," said Yvonne Ou, MD, at the University of California, San Francisco.



EXERCISE CAUTION. Patients with glaucoma may need to modify or skip certain poses, such as downward-facing dog.

Clues from animal research. According to Dr. Ou, recent animal studies add to the evidence that physical activity protects against glaucoma damage.

In a murine study that examined the role of exercise in a transient ocular hypertension model, exercise was able to reverse signs of age-related vulnerability to optic nerve injury, such that the signs of injury in older mice that had completed the exercise regimen were similar to young mice that were not exercised.⁴ The investigators then went on to show that exercise may prevent the injury-induced loss of brain-derived neurotrophic factor (BDNF) in the retina. (The group also has recently demonstrated that a high-fat high-sucrose diet made the mouse optic nerve more vulnerable to injury, but that exercise did not offset the negative effects of this diet.⁵)

Strength Training: Maybe

Lack of clarity. Relatively few studies have been conducted on weight training's effect on IOP. Moreover, the results have been contradictory:

- Several years ago, Dr. Ritch's group evaluated the effect of bench pressing on IOP in 29 normal subjects, and a number of them experienced rises in IOP during the exercise.⁶ "The study hasn't been done in people with glaucoma, but I presume that glaucoma patients would have a more exaggerated response," Dr. Ritch said.
- In another study of 30 healthy individuals, the opposite occurred: Dynamic resistance exercises (chest and leg presses) induced moderate postexercise decreases in IOP.⁷

Advice for patients? Given the lack of clarity, Dr. Ritch's guidance for glaucoma patients comes down to the amount of weight being lifted. Is a patient working with 10-, 20-, or 30-pound weights—or much more

than that? "I caution patients with glaucoma about bench pressing 200 pounds, but a definitive study has not been done. If a patient has mild glaucoma, I tell them to go ahead with their routine unless they [experience] severe damage. I had one patient who lost his 3-degree island of vision in the middle of doing a crunch, and IOP can also rise in patients doing push-ups. I basically tell them to use common sense."

Avoid the Valsalva maneuver. It's crucial that the person continues to exhale during periods of maximum exertion. This helps the patient avoid the Valsalva maneuver, in which a person exhales forcefully with a closed mouth and nose and the windpipe is blocked by the closed epiglottis—which can increase IOP dramatically.

Yoga: It Depends

There's no clear evidence to suggest that certain yoga poses—especially if they are held for short periods—are detrimental to people's glaucoma, but there is reason for caution.

Just say no to headstands. Back in 1980, Dr. Ritch saw a 45-year-old woman with normal-tension glaucoma who had 5-degree fields. She had continued to progress despite consultation with clinicians at 12 institutions.

As it turned out, she had been standing on her head for 20 minutes a day for 20 years. When her IOP was measured while she was performing a headstand, it was 60 mm Hg. In contrast, it was 15 mm Hg while she was sitting. Dr. Ritch proceeded to take all of his lab colleagues and stand them on their

Analyzing Asana

Modifications of yoga poses allow practitioners to experience many of the benefits of the full poses without pushing, overstretching, and incurring injuries. (Modifications are also used to help yoga students recover from illnesses and injuries.) The following modifications may be appropriate for some glaucoma patients, as they help the person achieve gradation from minimal to large increases in IOP by attending to the relative heights of the eyes, heart, and the rest of the body.

Inversions

Legs-up-the-wall pose (Viparita Karani). If a patient goes from sitting on the floor to lying on her back with her legs up a wall, IOP rises only a little, Dr. Cole said, and even that can be partially reversed by elevating the head on a folded yoga blanket.

For a slightly steeper version of this inversion, which can be more calming, at the possible expense of slightly higher pressure in the eyes, he recommended adding a folded blanket or two under the pelvis and rolling the shoulders back to lift the chest (lifting the chest elevates the heart a little).

Plow pose (Halasana) and

shoulderstand (Sarvangasana). For a strong inversion that is expected to produce only a moderate increase in IOP, consider plow pose or full shoulderstand. "Although these poses raise the heart, abdomen, and pelvis [and in the case of shoulderstand, the legs] quite high—and you can't mitigate these factors by raising the head because that would flex the neck too strongly—they are unlikely to raise IOP to an extreme," Dr. Cole said. This is because the flexed position of the neck raises the eyes somewhat relative to the heart.

By contrast, headstand (Sirsasana) is likely to increase IOP maximally because it places the eyes as far as possible below the heart while lifting the abdomen, pelvis, and legs as far as possible above the heart.

Forward Bends

Forward seated bend pose (Paschimottanasana). In the full version of this pose, the person sits on the floor, bends forward, and rests the head on the knees. But modifying the pose—by having the person rest the forehead on a padded chair seat—keeps the eyes above the heart and most of the rest of the body below it, presumably keeping IOP low.

Forward standing bend pose

(Uttanasana). As with the seated version, the person bends forward from the waist and the head is brought toward the knees. Standing in front of a chair that has a high stack of blankets on the seat, bending forward, and resting the forehead on the stack will likely raise IOP much less than bending forward without support and hanging the head.

Downward-facing dog pose

(Adho Mukha Svanasana). Two modifications to consider in practicing downward-facing dog pose: 1) Rest the hands on a chair (on the seat or on the top of the chairback), or 2) place the hands on the floor while elevating the forehead on a yoga block or on one or more folded blankets. Either modification will probably prevent IOP from rising as much as it would if the head were allowed to dangle downward or rest on the floor.

Another option: Practice the pose at the wall. In this variation (commonly known as half dog), the hands are placed on the wall, and the person steps back from the wall, bending forward at the hips. The head is kept in line with the arms and not allowed to drop down toward the floor.

heads. Everyone's IOP roughly doubled.

Subsequent studies and case reports tested headstand pose, demonstrating a twofold rise in IOP.⁸ "Doing headstands and shoulderstands is a real no-no for glaucoma patients, especially if you're going to do them for 20 minutes a day," Dr. Ritch said.

What about downward-facing dog?

But what about other head-down positions? Yoga students routinely practice a number of poses in which the head is positioned below the heart.

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.⁹ 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.

Can modifications help? For glaucoma patients, the safest way to practice yoga is to avoid inversions altogether, said Roger Cole, PhD, a research scientist and Iyengar yoga instructor based in Del Mar, California. However, he said, when a patient who has mild glaucoma also has a passion for yoga, their ophthalmologist and yoga teacher may be able to help them design a modified practice that diminishes the potential effects on IOP.

"The most important factor determining an inverted posture's effect on IOP appears to be the vertical distance of the eyes below the heart," said Dr. Cole. "Elevating the legs, pelvis, and abdomen above the heart may also raise IOP but seems to have a smaller effect."

For example, he noted, "in Dr. Ritch's yoga study, the two postures that placed the eyes furthest below the heart [down-

Advice to Yoga Practitioners

Dr. Cole offers the following advice to yoga students with glaucoma:

- Have your glaucoma medically treated before practicing.
- Get your doctor's OK before practicing inverted postures or any pose that places your head below your heart.
- Modify or substitute inverted poses to reduce their effects on eye pressure.
- Enter inverted postures slowly.
- Avoid strenuous inversions. Yoga is not about "no pain, no gain."
- Exhale gently and slowly. Avoid holding the breath or restricting the exhalation. If you practice pranayama (yoga breathing techniques), avoid the classical exhalation phase of the Ujjayi breath, as it involves making a "haaaah" sound through a restricted throat. Instead, exhale normally.
- Practice a form of yoga that has you move slowly, provides props, and adapts postures to your needs. Iyengar yoga is the best-known example of this approach.
- Find a teacher who is compatible with you, willing to work with special needs, and knowledgeable about adapting postures.
- Practice mindfully. "Relax your mind and body everywhere you can, then do whatever it takes to get into the pose as far as is reasonable for you at that moment, without disturbing your mind," Dr. Cole said.

ward-facing dog and standing forward bend poses] raised IOP by about 10 mm Hg even though the feet remained on the floor." In contrast, he said, "the two postures that kept the eyes at or only slightly below heart level while lifting the legs, pelvis, or abdomen the most [plow and legs-up-the-wall poses] raised IOP by 4 mm Hg, on average." Knowing this makes it easier to select and modify inversions based on their likelihood of raising IOP (see "Analyzing Asana").

Take-Home Message

The last thing a clinician wants to do is discourage patients from exercising. Rather, it's critical to ask patients about their activities and discuss limits and modifications when necessary.

Finally, what about Dr. Ritch's patient, who had been standing on her head for 20 minutes a day for 20 years? She stopped doing headstand pose—and her glaucoma stopped progressing.

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