

## References

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## Footnotes and Disclosure

The authors have no proprietary or commercial interest in any materials discussed in this article.

## Intraocular pressure fluctuations in a professional woodwind musician with advanced glaucoma



Ocular hypertension and fluctuations in intraocular pressure (IOP) are critical modifiable risk factors for the development and progression of glaucoma. Transient IOP elevations while playing wind instruments have been observed in musicians with<sup>1</sup> and without<sup>2,3</sup> glaucoma. However, the comparative effect of trabeculectomy surgery on IOP fluctuations during wind instrument performance has not been previously described.

We report a 62-year-old oboist with advanced pseudoexfoliation glaucoma in the right eye and moderate primary open-angle glaucoma in the left eye. Her glaucoma was initially controlled with topical medications and selective laser trabeculectomy in both eyes.

Three years following presentation, glaucoma in the right eye progressed. No evidence of progression was noted in the left eye. Trabeculectomy with mitomycin-C was performed in the right eye. At 6-month follow-up, visual acuity was 20/25 OD and 20/20-2 OS. IOP via Goldmann applanation tonometry (GAT) was 8 mm Hg OD and 15 mm Hg OS. Topical therapy in the left eye consisted of latanoprostene bunod 0.024% daily and brinzolamide 1%–timolol 0.5% twice daily.

The patient was concerned about the effect of playing the oboe on the IOP in both eyes. To determine her risk of IOP elevation, we measured her IOP while she performed classical pieces and musical exercises on the oboe. Measurements were obtained with GAT at baseline and repeated at periodic rest intervals. A handheld tonometer (Tono-Pen XL; Reichart Inc, Depew, NY) was used at corresponding time points to measure IOP while the patient played the oboe.

To assess the IOP during a typical classical music performance, we measured IOP every 20 seconds in each eye while our patient played the oboe for  $\geq 3$  minutes. Pieces by composers Telemann and Mozart were played using low- and high-resistance reeds, respectively. A rest period of 5 minutes was given between each piece. Next, we recorded the IOP every 20 seconds during playing of sustained notes of low (B flat, below treble clef), middle (B flat, middle of treble clef), and high

frequency (D, above treble clef), each held for up to 1 minute and separated by 30-second rests.

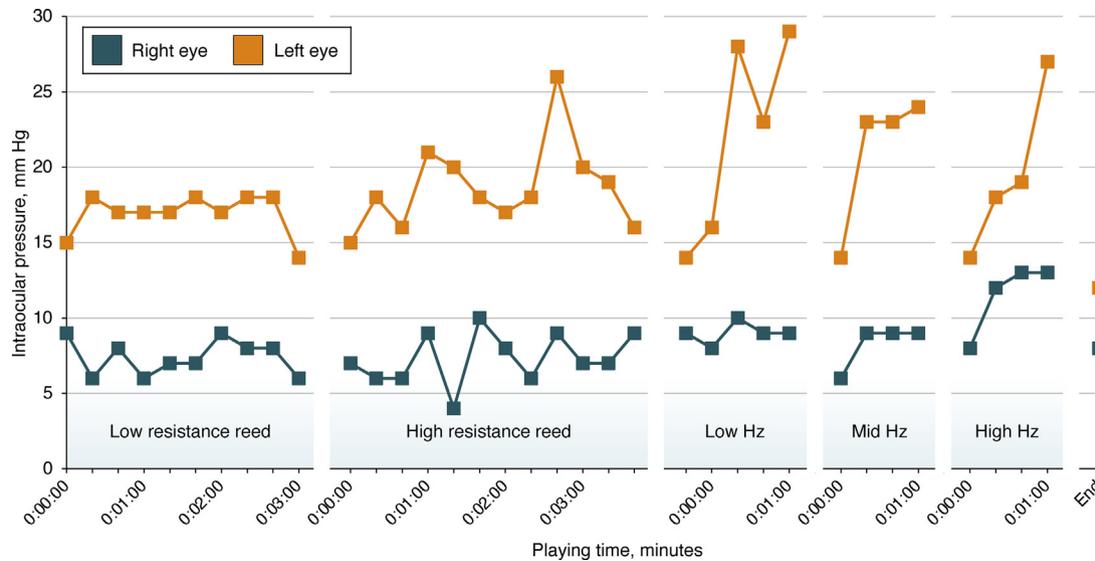
The baseline IOP was 8 and 15 mm Hg measured with GAT and 9 and 15 mm Hg measured with the handheld tonometer in the right and left eyes, respectively. During performance with a low-resistance reed, the IOP in the right eye did not elevate higher than 9 mm Hg (Fig. 1). In the left eye, the IOP increased up to 18 mm Hg and remained steady over 3 minutes. The IOP in both eyes returned to baseline within 5 minutes. During performance with a high-resistance reed, the IOP elevated to 10 mm Hg OD and 26 mm Hg OS. During playing of sustained notes, the IOP increased bilaterally with all 3 notes. The peak IOP OD was 13 mm Hg during playing of a high-frequency note. In the left eye, IOP rose sharply with all sustained notes, peaking at 29 mm Hg during playing of a low-frequency note. Following a final rest of 5 minutes, the IOP measured 7 mm Hg OD and 16 mm Hg OS with GAT.

The oboe is a high-resistance double-reed woodwind instrument originating in 17th century France. Previous studies have described IOP elevations in oboists and other musicians playing both high-resistance (e.g., trumpet, French horn) and low-resistance (e.g., saxophone, tuba) wind instruments.<sup>2,3</sup> IOP elevations have been associated with playing higher-frequency notes and louder volumes,<sup>2</sup> but the magnitude of IOP rise during and following performance can vary widely between subjects. Differences in IOP response between subjects with or without glaucoma have not been observed.<sup>1</sup>

The proposed mechanism for IOP elevation during wind instrument performance is akin to that of a Valsalva maneuver, which leads to elevated IOP via a rise in intrathoracic venous pressure.<sup>4</sup> This venous pressure increase is transmitted upward, ultimately to vortex veins and the choroid, bringing about vascular engorgement and a rise in IOP.<sup>4</sup> In light of the suggested pathophysiology, the presence of a trabeculectomy in our patient's right eye could explain why the IOP did not rise to the same degree as in the medically treated left eye during playing of sustained notes. In the literature, 1 other patient with bilateral trabeculectomies was described to have minimal rises in IOP in both eyes while playing the trombone,<sup>1</sup> but no prior reports have compared the IOP in an eye following trabeculectomy with the medically treated fellow eye of the same patient.

The risk of glaucomatous optic neuropathy in wind instrument musicians is not well known. Life hours of high-

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**Fig. 1** – Intraocular pressure measured with a handheld tonometer in the right and left eyes during oboe playing. Low- and high-resistance reeds were used to perform various classical music pieces, followed by playing of sustained low-, middle-, and high-frequency (Hz) notes. Breaks of 5 minutes were given between classical music pieces, and breaks of 30 seconds were given between sustained notes. The final intraocular was measured following a 5-minute break.

resistance wind instrument playing have been suggested to be associated with visual field abnormalities.<sup>3</sup> A study comparing wind instrument and non-wind instrument musicians found no differences in glaucomatous-appearing optic nerves.<sup>5</sup> However, a nonstatistically significant higher incidence of visual field abnormalities correlating with cumulative time of playing was noted in wind instrument players.

While studies have provided insights into group effects, counselling individual patients with glaucoma who are wind musicians remains challenging because not all display clinically significant IOP rises during playing. In addition to fluctuations in IOP during oboe playing, a history of pseudoexfoliation in our patient's right eye also would be expected to result in greater IOP fluctuations. In our patient, in the eye with advanced pseudoexfoliation glaucoma treated with trabeculectomy, we found only transient and minimal IOP elevations while playing most musical pieces on the oboe and only transient and moderate IOP elevations while playing a high-frequency sustained note. This is in contrast to the fellow eye with moderate primary open-angle glaucoma treated medically, where modestly significant IOP elevations were recorded during regular playing and marked elevations during sustained notes. This suggests that the presence of a filtration bleb is protective against marked rises in IOP during oboe playing. We counselled our patient that playing sustained notes >30 seconds without exchanging breaths is of higher risk in elevating IOP. With modifications of her playing technique, she will be able to continue her work as a music instructor and performing in the symphony orchestra.

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