Purpose: To demonstrate any transient short-term effect of a particular type of breathing exercise (alternate nostril breathing of Nadi Shuddhi type of pranayama exercise) on the intraocular pressure (IOP) in glaucomatous as well as healthy eyes.

Methods: A prospective, nonrandomized, observational, cross-sectional study was conducted in a tertiary eye-care hospital setup recruiting 3 groups of subjects—glaucoma group and a normal group that underwent the breathing exercise as well as a normal group that did not. IOP was recorded at baseline, then at 4 minutes after 10 cycles of the breathing exercise and also after 10 minutes of rest—corresponding to IOPb, IOPc, and IOPr of all the study groups. Only those subjects were recruited who were above 18 and under 80 years and were naive to breathing exercise.

Results: A total of 56 normal eyes (28 subjects, Normala) and 33 glaucomatous eyes (19 subjects) were recruited for the breathing exercise and were compared with the IOP as obtained for 26 eyes of 26 subjects that did not undergo the breathing exercise (Normalb). IOPc did not differ between both normal groups (13.7 ± 1.4 mm Hg in Normala vs. 13.9 ± 1.6 mm Hg in Normalb, P = 0.183) but was significantly different between groups (16.7 ± 3.1 mm Hg in the glaucoma group and 13.7 ± 1.4 in Normals, P < 0.001) and Normalb, 15.9 ± 1.6 mm Hg, P < 0.001) but analysis of variance was not significant within groups comparing IOPb, IOPc, and IOPr of all the study groups.

Conclusion: There is no short-term transient effect of alternate nostril breathing exercise on IOP; a longitudinal study is recommended.

Key Words: alternative therapy, breathing exercise, alternate nostril breathing, intraocular pressure, glaucoma, yoga, pranayama

Received for publication May 22, 2020; accepted September 7, 2020.

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Disclosure: V.P.R., Santen, Novartis, Allergan. The remaining authors declare no conflict of interest.

Supplemental Digital Content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's website, www.glaucomajournal.com.

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DOI: 10.1097/IJG.0000000000001682
surgery and were either naive to breathing exercise or had not actively performed it in the past 3 months.

Inclusion criteria for normal study subjects (with breathing exercise, Normalb and without breathing exercise, Normalnb)—normal eyes of subjects above 18 and under 80 years that did not have any ocular disease, other than cataract, and were naive to breathing exercise.

Exclusion criteria in all groups—any active ocular surface disease, any active ocular inflammation, any refractive surgery or intraocular surgery (other than trabeculectomy in the glaucoma group and cataract surgery in all the groups), sinusitis, self-reported breathing problems or asthma or on inhalers and heart disease. Lactating or pregnant females were also excluded.

Baseline IOP (IOPb) was measured with Goldmann applanation onometer (GAT) and the study subjects performed 10 cycles of pranayama following which GAT was recorded again (IOPc). A final reading of IOP was taken after 10 minutes (IOPr). The same procedure was performed in normal and glaucomatous study subjects. Data was also obtained for a third group (Normalnb) who did not undergo the breathing exercise but had IOP recorded at baseline, then at 4 minutes and 10 minutes—corresponding to IOPb, IOPc and IOPr of the study groups. All 3 readings were taken by a single observer with the same tonometer, reducing interobserver variation and errors caused due to the change in instrument.

Ethics approval from the Institutional Ethics Committee of the University was obtained. Informed consent was taken from each participant and data handling was as per the tenets laid down by the declaration of Helsinki.

Data analysis was done using the IBM SPSS statistics 22.0 software.

RESULTS

Fifty-six normal eyes (28 subjects, Normalb) and 33 glaucomatous eyes (19 subjects) were recruited for the breathing exercise and were compared with the IOP as obtained for 26 eyes of 26 subjects that did not undergo the breathing exercise (Normalnb).

Mean age of patients with glaucoma was 58.9 ± 4.2 years and those for Normalb was 33.8 ± 13.1 years (P < 0.001). Mean age of Normalnb group was 36.4 ± 11.2 years, P = 0.156 when compared with Normalb and <0.001 when compared with the glaucoma group. The etiology of glaucoma in each eye of the study subjects, in descending order, included—primary angle-closure glaucoma (n = 20), primary open-angle glaucoma (n = 7), combined mechanism glaucoma (primary open-angle glaucoma converting to primary angle-closure glaucoma) (n = 4), and normal tension glaucoma (n = 2).

IOPb did not differ between both normal groups (13.7 ± 1.4 mm Hg in Normalb vs. 13.9 ± 1.6 mm Hg in Normalnb, P = 0.183). Glaucoma patients were on 1.7 ± 1.3 anti-glaucoma medication and IOPb was significantly different between groups (16.7 ± 3.1 mm Hg and 13.7 ± 1.4 in Normalb, P < 0.001 and Normalnb 13.9 ± 1.6 mm Hg, P < 0.001). Analysis of variance of IOP within groups immediately after 10 cycles (IOPc) and 10 minutes later (IOPr) was not significant in the glaucoma group (IOPc 16.9 ± 3.3 mm Hg, IOPr 16.8 ± 3.0 mm Hg; P = 0.308) as well as in Normalb (IOPc 13.7 ± 1.8, IOPr 13.5 ± 1.7; P = 0.154) and in Normalnb [IOPc (without breathing exercise), 13.6 ± 1.9 mm Hg, IOPr 13.5 ± 1.8 mm Hg; P = 0.106], respectively (Fig. 1).

The results did not differ even when only 1 eye was selected randomly for analysis in the glaucoma group (19 eyes) and compared with 26 eyes each in Normalb and Normalnb.

DISCUSSION

Our results show that there is no statistically significant change in IOP immediately after 10 cycles of NS pranayama and 10 minutes after relaxation in either of the groups that underwent the breathing exercise, when compared with...
baseline. Furthermore, there appeared to be no difference in both groups of normals—the one that undertook breathing exercise and the one that did not.

Unlike the observations of Schuman et al\textsuperscript{6} who carried out their IOP observations with pneumotonometry in individuals while blowing wind instruments in the supine position, we chose GAT for IOP measurements as the breathing exercise is in an upright seated position. The increase in IOP that Schuman et al\textsuperscript{6} reported was due to Valsalva-type maneuver and venous engorgement that was demonstrated in uveal tissues via ultrasound biomicroscopy. NS pranayama is probably far gentler as we could not demonstrate any transient change in IOP, in either the glaucomatous or healthy eyes.

Breathing exercises are a very common practice in India in patients with chronic diseases as this alternative therapy brings about comfort and contentment. Therefore, recruitment of breathing-exercise naive subjects in the glaucoma group was expectedly difficult. It is very evident from literature that longer term practice of pranayama tilts the systemic balance toward parasympathetic tone which has the capability of reducing stress, decreasing heartbeat, and blood pressure as well as increasing blood supply to the vital organs in the body.\textsuperscript{7,8} On the other hand, as there is also some evidence that ocular and cerebral blood flow is reduced in glaucoma due to sympathetic mediated vasospasm and ischemia,\textsuperscript{9} observations involving IOP and visual fields with longer term practice of breathing exercises may yield differing results. This was beyond the ambit of this cross-sectional study and therefore the study was limited to the breathing itself, without an emphasis on the meditational aspects of Yogic breathing exercise.

Other limitations of the study include the nonrandomized design, the lack of inclusion of a glaucoma-no-breathing-exercise group and recruitment of the Normal\textsubscript{data} group after the other 2 groups. Furthermore, the cohort sizes were not large enough to undertake other exploratory analyses such as sensitivity to age, baseline untreated IOP, or type of glaucoma.

We conclude that there is no short-term transient effect of Yogic breathing exercise (Nadi Shuddhi or alternate nostril breathing) on IOP. However, study of longer-term practice of breathing exercise and its effect on IOP in a longitudinal study is highly recommended, as this kind of alternate therapy may contribute immensely to a patient’s well-being.

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