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RESEARCH ARTICLE

Acute effects of yoga on ocular perfusion pressure in adult yoga practitioners

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ABSTRACT

Background: Ocular perfusion pressure (OPP) is an important determinant of ocular blood flow. Reduced OPP could be a risk factor for glaucoma. According to the WHO, glaucoma is the second leading cause of blindness in the world. Yoga harmonizes the body with the mind. Studies have demonstrated that yogic exercises affect blood pressure (BP) as well as intraocular pressure (IOP). Although OPP depends on BP and IOP, not much of research has been done to analyze the impact of yoga on OPP. **Aims and Objectives:** The aim of the study is to analyse the immediate and composite effects of yoga on OPP in adult yoga practitioners. **Materials and Methods:** 32 healthy adult yoga practitioners in the age group of 18-25 years, were selected. Basal IOP and BP were recorded in sitting position using rebound tonometer and sphygmomanometer, respectively. The second recording was done immediately after 45 min of yoga practice. Mean OPP (MOPP) was calculated. **Results:** There was no significant difference in the IOP of both eyes before and after yoga. Statistically significant fall in the mean arterial pressure (MAP) and OPP of both eyes was observed immediately after yogic exercises ($P < 0.001$). **Conclusion:** In this study, MAP was reduced and IOP remained unchanged following yoga. This implies that simple yoga exercises may be useful as supplementary antihypertensive therapy. Although OPP was reduced in our study, autoregulation might maintain blood flow despite changes in perfusion pressure. More insight into ocular blood flow regulation can be studied using optical coherence tomography.

KEY WORDS: Intraocular Pressure; Mean Arterial Pressure; Ocular Perfusion Pressure; Yoga

INTRODUCTION

Yoga is an ancient Indian practice and a holistic model to well-being that seeks to harmonize the body with the mind through breathing techniques and physical postures.

Ocular perfusion pressure (OPP) is an important determinant of ocular blood flow. It also reflects the vascular status of the optic disc. Reduced OPP could be the probable risk factor for the increasing incidence and progression of glaucoma. According to the WHO, glaucoma is the second leading cause of blindness in the world. This can affect the quality of life significantly.

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Previous studies have stated that there is a significant reduction in blood pressure (BP) following yoga[1] and that the head down yogic postures affect intraocular pressure (IOP).[2,3] It is also observed that reduced OPP is associated with glaucoma.[4]

Although OPP depends on BP and IOP, not much of research has been done to analyze the impact of yoga on OPP. Studies have shown the effects of yoga on BP and IOP individually. However, there is lack of literature to prove the effects of

yoga on these interdependent parameters of ocular blood flow. Hence, this study was undertaken to assess the composite effects of the yoga on OPP.

The main objective of the study was to evaluate the immediate effects of yoga on OPP in adult yoga practitioners.

MATERIALS AND METHODS

This cross-sectional study was undertaken in the Government naturopathy and yoga medical college, Mysore. 32 healthy adult yoga practitioners in the age group of 18-25 years, who practiced yoga for minimum duration of 6 months were included in the study group. Ethical clearance was taken from the Institutional Ethical Committee. After obtaining informed written consent, history, and anthropometric measurements were recorded. Participants with h/o glaucoma, conjunctivitis, hypertension, smoking, alcohol consumption, and contact lens users were excluded from the study. The participants were asked to rest for 15 min following which basal IOP and BP was recorded in sitting position using rebound tonometer and sphygmomanometer, respectively. The second recording was done immediately after 45 min of yoga practice which included loosening exercises, suryanamaskar, balasana, adho mukha svanasana, and paschimottanasana. All the recordings were done between 4 pm and 6 pm by the same person to minimize, the bias of examiners and diurnal variations of IOP.[5]

OPP was calculated using the formula, mean OPP (MOPP) = (2/3) mean arterial pressure (MAP) - IOP.[5]

MAP = diastolic BP + (1/3) (pulse pressure); where pulse pressure = systolic BP - diastolic BP.

Descriptive statistical measures such as percentage, arithmetic mean and standard deviation was applied. Inferential statistical tests such as paired *t*-test were used to compare the parameters before and after yoga.

RESULTS

This study comprised of 32 participants with a mean age of 20 years. A significant fall of 4.81 mmHg in the MAP was observed immediately after yogic exercises. There was no significant difference in the IOP (0.25 mmHg in the right eye and 0.11 mmHg in left eye) before and after yoga.

OPP of both eyes revealed a statistically significant fall (3.47 mmHg in the right eye and 3.05 mmHg in left eye) following yogic exercises (Table 1).

Table 1: Comparison of study variables before and after yoga

Parameter (mmHg)	Before yoga (*n*=32)	After yoga (*n*=32)	*P* value
SBP	108.50±19.28	101.03±19.33	0.001
DBP	71.94±13.05	68.44±13.59	0.001
MAP	84.10±14.94	79.29±15.25	0.000
R-IOP	14.87±2.73	15.12±2.84	0.402
L-IOP	15.03±2.90	14.92±2.70	0.640
R-OPP	41.25±7.84	37.78±8.09	0.000
L-OPP	41.01±7.79	37.96±8.00	0.000

MAP: Mean arterial pressure, R-OPP: Right-ocular perfusion pressure, L-OPP: Left-ocular perfusion pressure, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, R-IOP: Right-intraocular pressure, L-IOP: Left-intraocular pressure

DISCUSSION

The present study was conducted to determine the effects of yoga on BP, IOP, and OPP in adult yoga practitioners. Our results demonstrated a significant reduction in MAP following yogic exercises ($P < 0.001$). There was no significant change in the IOP after yoga. However, we observed a statistically significant fall in OPP following yoga.

The reduction in MAP noted in our study is in accordance with a study on yoga and hypertension done by Wolff et al.[6] Although there was a change in IOP following yoga, it was not statistically significant. This observation is in contradiction to another study which states that yogic poses such as adho mukha svanasana and uttanasana were associated with greater IOP elevation.[2] There was a significant fall in OPP following yogic postures. A multivariate analysis supports the idea that OPP does not play a major role in the pathogenesis of optic neuropathy and was not correlated with optic nerve damage.[7] Since the participants in our study were normal young yogic practitioners, their eyes may contain healthier, more resilient blood vessels that are adaptable to changes in OPP.[8] In addition, change in OPP might not affect the vascularity of the optic disc due to autoregulation. Autoregulation is the ability of a vascular bed to maintain its blood flow despite changes in perfusion pressure. The mechanisms of autoregulation are complex and not fully understood. This warrants further studies with Doppler optical coherence tomography, a technique capable of measuring ocular blood flow.[9]

Limitation of the study is smaller sample size and it has to be done on a larger population. The results of our study could be evaluated on hypertensive patients as a clinical trial.

CONCLUSION

In our study, MAP was reduced and IOP remained unchanged following yoga. These results suggest that simple yogic exercises might be useful as a supplementary therapy for hypertension in addition to medical treatment.[6] However, further studies on hypertensive patients are needed to confirm the antihypertensive effect of yoga. Although OPP was

reduced, autoregulation might maintain blood flow despite changes in perfusion pressure in young adults. Currently, there is a lack of data describing the relationship between yoga, OPP and glaucoma. Hence, this study has to be extended on hypertensive glaucoma patients to confirm the effects. If the long-term effects of yogic exercises on hypertension and glaucoma are established, it could be exceedingly useful as an adjuvant therapy.

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