

Effects of Periocular Acupoint Massage on Intraocular Pressure and Aqueous Humor Drainage Pathway: A Randomized, Crossover Trial

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Article

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Abstract

Background

To investigate the immediate effects of standardized ocular acupoint massage on intraocular pressure (IOP) and conventional aqueous humor outflow pathway morphology in healthy young adults, and to differentiate acupoint stimulation from non-specific mechanical effects.

Methods

Fifty-eight healthy participants (23.10 ± 2.10 years) received, in randomized order, Standard Chinese Acupoint Eye Exercise (SCAEE) and Sham Acupoint Eye Exercise (SAEE). IOP was measured by rebound tonometry. SS-AS-OCT quantified Schlemm's canal (SC) and trabecular meshwork (TM) morphology. Autonomic indicators and optic disc blood flow were also monitored.

Results

IOP decreased in both groups, with greater reduction after SCAEE (from 16.10 ± 3.43 to 14.49 ± 3.15 mmHg, $P < 0.001$) than after SAEE (from 15.36 ± 3.18 to 14.67 ± 3.13 mmHg, $P = 0.019$). SCAEE significantly increased SC diameter/area and TM width in nasal and temporal regions (all $P < 0.001$) and decreased nasal TM thickness ($P = 0.013$). SAEE only slightly reduced temporal SC diameter ($P = 0.046$), with no other TM/SC changes. SCAEE also reduced pupil diameter and blood pressure (SBP $P < 0.001$; DBP $P = 0.002$), increased retinal thickness, and decreased choroidal thickness ($P < 0.00556$); SAEE did not.

Conclusions

Ocular acupoint massage immediately reduces IOP in healthy young adults, associated with targeted expansion of the primary aqueous outflow pathway (SC/TM) and autonomic modulation, effects superior to non-acupoint stimulation. This study provides initial imaging and physiological evidence supporting acupoint massage as a novel non-invasive adjunctive approach for IOP control. However, only acute changes were assessed; further research is needed on long-term efficacy and safety.

Introduction

Glaucoma is the leading irreversible blinding eye disease worldwide¹. It is estimated that the global number of individuals affected by glaucoma will increase by 74% between 2013 and 2040¹. Among numerous risk factors, intraocular pressure (IOP) is the only one that can be effectively controlled through clinical intervention². Currently, IOP-lowering treatments, including medications, laser therapy, and surgery, remain the mainstay of glaucoma management³. However, the economic burden of long-term medication use, drug side effects, challenges with patient adherence, as well as the trauma and risks associated with surgical procedures, continue to drive the exploration of complementary therapies for IOP control.

Since the last century, Chinese eye exercises have been advocated as an important method to delay the progression of refractive errors⁴. Similar to the eye exercises, ocular acupoint massage is a non-invasive technique based on traditional Chinese medical theory, which applies manual pressure to specific acupoints on the body to promote recovery⁵. By applying pressure to specific acupoints, the practitioner aims to unblock the meridian qi and blood flow around the eyes, regulate the functional harmony of the internal organs, and stimulate yang qi circulation around the eyes⁶⁻⁸. Clinically, ocular acupoint massage has been used as an adjunctive therapy for various eye conditions, and its effectiveness is widely recognized by practitioners both domestically and internationally^{9,10}.

Numerous studies have confirmed that changes in IOP are directly related to aqueous humor drainage, and IOP can be regulated by modulating ocular circulation and the dynamics of the aqueous outflow pathways^{11,12}. The conventional outflow pathway for aqueous humor primarily includes structures such as Schlemm's canal (SC) and the trabecular meshwork (TM). Alterations in the diameter and area of SC, as well as the width and thickness of TM, significantly impact the outflow resistance of aqueous humor^{11,13,14}. Although the application of acupoint therapy in ocular diseases has garnered increasing attention, rigorous clinical evidence is still lacking regarding whether ocular acupoint massage has an IOP-lowering effect and how it influences the anatomical structures of these key aqueous outflow pathways.

This study hypothesizes that ocular acupoint massage can effectively reduce IOP by modulating the structure and function of the conventional aqueous outflow pathway. To test this hypothesis, a self-controlled study design was employed to compare the effects of standard acupoint massage versus sham acupoint massage on IOP and the aqueous outflow pathway, aiming to differentiate the specific effects of acupoint stimulation from non-specific mechanical intervention. Concurrently, we also monitored the impact of acupoint massage on blood flow in the

optic disc region. Utilizing advanced imaging techniques such as swept-source anterior segment optical coherence tomography (SS-AS-OCT), changes in IOP, SC morphology, and TM parameters were quantified to explore the potential of ocular acupoint massage as a novel non-invasive adjunctive therapy for glaucoma treatment.

Materials and Methods

Study Design and Participants

This study was conducted from late January to February 2026 and enrolled a total of 58 participants. The study employed a self-controlled design. All participants underwent both intervention protocols, with the order of the two intervention groups being randomized. The interventions for the different groups were administered on separate days, with an interval of at least 48 hours between the two procedures. All examinations were performed between 16:00 and 21:00 daily. The study was conducted in accordance with the principles of the Declaration of Helsinki, approved by the Ethics Committee of Zhongnan Hospital of Wuhan University (Approval No.: 2023056K-1K), and registered on a clinical trial registry platform (NCT06293196). Prior to enrollment, all participants provided written informed consent.

Inclusion and Exclusion Criteria

Inclusion Criteria: Healthy individuals of all ages were eligible. Exclusion Criteria were defined as follows: (1) Presence of systemic diseases; (2) History of other ocular diseases, surgery, medication, or ocular trauma; (3) Consumption of coffee, tea, or vasodilators within six hours prior to testing; (4) Children, pregnant women, and lactating mothers were excluded. Withdrawal Criteria included: (1) Participants unable to cooperate with the examination; (2) Poor quality of scanned images.

Participants underwent two study conditions in a randomized order: 1. Standard Chinese Acupoint Eye Exercise (SCAEE) Group: Participants first rested quietly for 15 minutes to achieve a resting state. Subsequently, a trained ophthalmic healthcare professional administered a 5-minute standardized acupoint eye exercise massage, which included: (1) Press and rub Tianying point; (2) Press and rub Jingming point; (3) Press and rub Sibai point; (4) Press and rub the Taiyang point with the thumb, then use the side of the index finger to massage along the upper and lower edges of the eye socket. This technique stimulates the Cuanzhu, Yuyao, Sizhukong, Chengqi, and Tongziliai points in sequence. 2. Sham Acupoint Eye Exercise (SAEE) Group: After resting quietly for 15 minutes, participants received a 5-minute sham acupoint massage. The massage was applied to non-acupoint areas located 2 cm away from the actual acupoints, performed by the same trained ophthalmic healthcare professional. The massage locations for participants in both groups are illustrated in Figure 1. The order of the two interventions was randomly assigned for each participant to eliminate order effects. Researchers measuring the outcome indicators were blinded to the intervention type to minimize measurement bias.

Image and Data Acquisition

IOP was measured using an ICARE 100 rebound tonometer immediately before and after each intervention, and the average of 6 repeated measurements was recorded. Images of the nasal and temporal corneoscleral region and anterior segment of the right eye (Figure 2) were acquired using a SS-AS-OCT system (Casia SS-1000; Tomey Corporation, Nagoya, Japan). Two trained researchers manually delineated SC and the TM. The diameter and area of SC, as well as the width and thickness of TM, were measured. Researchers manually delineated the contour of SC, and the area enclosed by this contour was automatically calculated by the instrument, which was defined as the area of SC. The diameter of SC was obtained by measuring the distance from the posterior margin to the anterior endpoint of its contour. The width of the TM was defined as the distance from the scleral spur to the Schwalbe line. The thickness of the TM was defined as the average of two measurements taken at the anterior endpoint and the midpoint of SC. The average of the two measurements was used for subsequent analysis. Retinal and choroidal vascular parameters in the optic disc region of participants were measured before and after the interventions using a swept-source optical coherence tomography angiography (SS-OCTA) system (SS-OCTA, VG200; SVision Imaging, Ltd., Luoyang, China).

Statistical Analysis

Statistical analysis was performed using Stata software version 26.0 (SPSS, Inc, Chicago, IL). GraphPad Prism 9.0 software (GraphPad Software, San Diego, CA, USA) was used for generating analytical graphs. The normality of parameters before and after each intervention was assessed using the Shapiro-Wilk test. If the data followed a normal distribution, paired-sample t-tests were used to compare differences before and after the intervention; if not, the Wilcoxon signed-rank test was applied. To determine whether there were between-group differences in the effects of the two intervention methods, independent-sample t-tests or Mann-Whitney U tests were performed on the differences between the groups. A P-value of <0.05 was considered statistically significant.

Results

Baseline Characteristics of Study Participants

Table 1 presents the baseline characteristics of the study participants. A total of 58 participants (29 males and 29 females) were enrolled, with a mean age of 23.10 ± 2.10 years.

Changes in Intraocular Pressure and Autonomic Nervous Activity Indicators

Table 2 and Figure 3 jointly present the changes in IOP and indicators of autonomic nervous activity before and after the interventions. In the SCAEE group, IOP decreased significantly from 16.10 ± 3.43 mmHg to 14.49 ± 3.15 mmHg (Wilcoxon signed-rank test, $P < 0.001$). In the SAEE group, IOP decreased from 15.36 ± 3.18 mmHg to 14.67 ± 3.13 mmHg (Paired-sample t-test, $P < 0.05$). Figure 3A clearly shows that IOP was significantly reduced after the intervention in both the SCAEE and SAEE groups, with a more pronounced reduction observed in the SCAEE group. In the SCAEE group, pupil diameter (PD) decreased from 5.23 ± 0.81 mm to 5.04 ± 0.83 mm (Paired-sample t-test, $P < 0.001$), systolic blood pressure (SBP) decreased from 111.78 ± 16.79 mmHg to 108.00 ± 16.12 mmHg (Paired-sample t-test, $P < 0.001$), diastolic blood pressure (DBP) decreased from 70.74 ± 11.05 mmHg to 68.40 ± 10.40 mmHg (Paired-sample t-test, $P = 0.002$), and heart rate (HR) decreased from 73.66 ± 11.11 bpm to 72.16 ± 11.87 bpm (Wilcoxon signed-rank test, $P = 0.047$) (Table 2, Figure 3B, Figure 3C). In the SAEE group, SBP decreased from 109.14 ± 16.23 mmHg to 105.53 ± 14.91 mmHg (Paired-sample t-test, $P < 0.001$), and DBP decreased from 68.72 ± 11.67 mmHg to 66.52 ± 10.71 mmHg (Paired-sample t-test, $P = 0.009$). However, no significant changes were observed in PD or HR (Table 2, Figure 3B, Figure 3D). Figure 3E shows that subjects with higher baseline IOP exhibited more pronounced changes in IOP following acupoint massage.

Changes in Schlemm's Canal and Trabecular Meshwork Before and After Intervention

Table 3 presents the changes in the diameter and area of SC, as well as the width and thickness of the TM in the temporal (T) and nasal (N) regions before and after the interventions in both groups. In the SCAEE group, the diameter and area of SC increased significantly in both the N and T regions. The width of the TM also increased significantly in both regions. The thickness of the TM decreased in the N region, while no significant change was observed in the T region. Specifically, the temporal SC diameter increased significantly from 0.199 ± 0.062 mm to 0.242 ± 0.077 mm (Wilcoxon signed-rank test, $P < 0.001$). The nasal SC diameter increased from 0.207 ± 0.057 mm to 0.245 ± 0.067 mm (Paired-sample t-test, $P < 0.001$). The temporal SC area increased from 0.006 ± 0.002 mm² to 0.008 ± 0.003 mm² (Wilcoxon signed-rank test, $P < 0.001$). The nasal SC area increased from 0.006 ± 0.002 mm² to 0.007 ± 0.003 mm² (Wilcoxon signed-rank test, $P < 0.001$). The temporal TM width increased from 0.605 ± 0.102 mm to 0.626 ± 0.096 mm (Wilcoxon signed-rank test, $P < 0.001$). The nasal TM width increased from 0.623 ± 0.100 mm to 0.642 ± 0.095 mm (Wilcoxon signed-rank test, $P < 0.001$). The nasal TM thickness decreased from 0.129 ± 0.058 mm to 0.123 ± 0.059 mm (Wilcoxon signed-rank test, $P = 0.013$). In the SAEE group, only the temporal SC diameter showed a significant decrease from 0.232 ± 0.062 mm to 0.220 ± 0.063 mm (Paired-sample t-test, $P = 0.046$). No significant changes were observed in nasal SC diameter, SC area (T or N), or TM width and thickness (T or N).

Changes in Retinal and Choroidal Thickness in the Optic Disc Region Before and After Intervention

Figure 4 illustrates the changes in retinal and choroidal thickness in the optic disc region before and after the intervention in both the SCAEE and SAEE groups. Orange represents an increase in thickness after the intervention, while blue represents a change in the opposite direction. The depth of color indicates the varying degrees of statistical significance for these changes. In the SCAEE group, acupoint massage led to increased retinal thickness in the NS, IT, ST, and SN quadrants within the 2-4mm region (Paired-sample t-test, $P = 0.00455$, $P = 0.00475$, $P = 0.00266$, $P = 0.00022$). Additionally, it resulted in decreased choroidal thickness in the 0-2mm region (Paired-sample t-test, $P = 0.00546$). In contrast, the SAEE group showed no statistically significant differences in retinal or choroidal thickness before and after the intervention. However, we did not observe significant changes in retinal perfusion area, vessel density, or choroidal large and medium vessel volume (CVV) and vascular index (CVI) between the two groups.

Intergroup comparison of intraocular pressure, autonomic nervous activity parameters, and aqueous humor outflow pathway indices between the two groups

Table 4 shows that significant intergroup differences were observed in the change of IOP between the two groups before and after intervention, with the SCAEE group showing a significantly greater IOP reduction than the SAEE group (Mann-Whitney U, $P = 0.002$). In contrast, no statistically significant intergroup differences were found in the changes of autonomic nervous function parameters, including PD, SBP, DBP and HR.

Significant intergroup differences were also detected between the SCAEE and SAEE groups in temporal SC diameter (Independent samples t-test, $P < 0.001$), temporal SC area (Mann-Whitney U, $P < 0.001$), temporal TM width (Mann-Whitney U, $P < 0.001$), nasal TM width (Mann-Whitney U, $P < 0.001$), and nasal TM thickness (Mann-Whitney U, $P = 0.033$). No significant differences were observed in the remaining parameters, including nasal SC diameter, nasal SC area and temporal TM thickness.

Discussion

Research on periocular acupoint massage and its effects on IOP and the aqueous humor outflow pathway indicates that periocular acupoint massage can significantly reduce IOP in young healthy individuals. This reduction is accompanied by targeted structural expansion of SC and the

TM, specifically manifested as an increase in SC diameter and area, as well as a widening of the TM. This structural change, likely a physiological response, may facilitate aqueous humor outflow and reduce IOP by transiently decreasing resistance in the primary drainage pathway.

In this study, alongside monitoring IOP, we also tracked autonomic nervous system indicators in participants, such as blood pressure, heart rate, and pupil diameter. The SCAEE group exhibited significant alterations in these autonomic nervous system indicators, primarily manifested as reduced pupil diameter and lowered blood pressure. The constriction of pupil diameter and the decrease in blood pressure suggest an increase in parasympathetic tone and a concomitant suppression of sympathetic activity¹⁵. Previous studies have shown that, changes in IOP are closely related to blood pressure. Tomoyo Yasukawa et al. observed a positive correlation between SBP and DBP levels, as well as the prevalence of hypertension, with IOP levels and the prevalence of ocular hypertension¹⁶. Research by Alessandro A. Jammal et al. demonstrated that systemic arterial blood pressure has a significant and independent effect on the rate of structural damage progression in glaucoma patients¹⁷. Given that blood pressure decreased in both groups, the greater IOP reduction observed in the SCAEE group cannot be attributed solely to systemic hemodynamic changes, indicating that neural regulation plays an important role in this process. Previous studies have shown that both blood pressure and pupil size are regulated by the dual innervation of the sympathetic and parasympathetic nervous systems^{15,18,19}. Furthermore, the structure and function of SC and TM are also modulated by the nervous system. Parasympathetic excitation is a potent stimulus for Nitric Oxide (NO) release. NO has been confirmed as an effective dilator of the SC and TM pathway²²⁻²⁵. Therefore, the IOP reduction observed following acupoint massage may be achieved by enhancing parasympathetic excitability, stimulating NO production, and thereby regulating the structural expansion of SC and TM. However, the specific mechanisms and related signaling pathways involved remain unclear.

Interestingly, we also observed a minor reduction in IOP and a decrease in blood pressure in the SAE group, but no targeted structural changes in SC or TM were detected. We hypothesize that this is because mechanical pressure applied to non-acupoint areas may stimulate terminal branches of the trigeminal nerve in the periorbital region, potentially triggering a reflexive oculocardiac-like response or other neurogenic reflex that leads to a transient, mild reduction in IOP, independent of direct mechanical compression of the globe. The magnitude of IOP reduction in the SCAEE group was significantly greater than that in the SAE group. This suggests that targeted acupoint massage yields superior IOP-lowering effects compared to simple mechanical pressure alone, highlighting the importance of accurate acupoint localization during massage.

In parallel, we also monitored changes in retinal and choroidal vascular parameters in the optic disc region before and after the research interventions in both groups. Following acupoint massage in the SCAEE group, an increase in retinal thickness and a decrease in choroidal thickness were observed. This indicates that periocular acupoint massage can exert immediate and direct effects on ocular vascular parameters, suggesting a redistribution of blood flow within the optic disc region post-massage. However, no significant changes were observed in the perfusion area or vessel density of the retina and choroid (Table S2-4). Numerous studies have shown a significant reduction in ocular blood flow in glaucoma²⁶⁻²⁸. This suggests that ocular blood flow may be associated with the progression of glaucomatous damage. However, the immediate increase in retinal thickness observed after acupoint massage represents a transient physiological response, and whether this acute change has any meaningful clinical impact on delaying the progression of optic nerve damage remains unknown and requires further investigation. In contrast, no statistically significant differences in retinal or choroidal thickness were found before and after the intervention in the SAE group.

This study has certain limitations. First, all participants were healthy young individuals with normal intraocular pressure, rather than glaucoma patients. Given that the aqueous outflow pathway in glaucoma patients may already exhibit structural or functional pathological alterations, their IOP regulatory response to acupoint massage might differ from that of healthy eyes. Therefore, the IOP-lowering effect of periocular acupoint massage in the glaucoma population remains unknown. Second, this study only observed immediate changes in IOP before and after the intervention and lacked long-term follow-up data, precluding an assessment of the long-term stability of its effects. Although the interventions for both groups in this study were performed by trained ophthalmic healthcare professionals, ensuring the accuracy of the massage, a certain degree of variability still existed between individual operations. In future research, we plan to conduct clinical trials involving glaucoma patients. A digitalized massage protocol will be employed to ensure completely consistent pressure, location, and frequency for each session. Long-term follow-up will be implemented to evaluate its efficacy. Furthermore, we will incorporate neuro-electrophysiological testing and specific biomarker analyses to clarify its mechanism of action, thereby enhancing the clinical translational value of this intervention.

In conclusion, this study employed SS-AS-OCT to conduct, for the first time, a quantitative correlative analysis of the effects of acupoint massage on IOP changes and morphological alterations in the aqueous humor outflow pathway. This work not only addresses the research gap in this field due to a lack of quantitative biometric evidence but also provides direct imaging and neuro-excitatory evidence for the potential mechanism through which acupoint massage lowers IOP. With its notable advantages of being non-invasive, cost-effective, and simple to perform, periocular acupoint massage holds promise as a potential adjunctive therapy for the long-term management of glaucoma.

Abbreviations

IOP
Intraocular pressure

SC
Schlemm's canal
TM
Trabecular meshwork
SS-AS-OCT
swept-source anterior segment optical coherence tomography
SCAEE
Standard Chinese acupoint eye exercise
SAEE
Sham acupoint eye exercise
SS-OCTA
Swept-source optical coherence tomography angiography
SL
Schwalbe line
SS
Sclera spur
PD
Pupil diameter
SBP
Systolic blood pressure
DBP
Diastolic blood pressure
HR
Heart rate
T
Temporal
N
Nasal

Declarations

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Contributions

WL: Conceptualisation, Data curation, Writing-original draft, Writing-review & editing, Validation, Methodology, Investigation, Formal analysis. XL: Conceptualisation, Data curation, Writing-original draft, Writing-review & editing, Validation, Methodology, Investigation, Formal analysis. YL: Conceptualisation, Writing-review & editing, Supervision, Methodology, Formal analysis. WZ: Conceptualisation, Writing-review & editing, Supervision, Methodology, Formal analysis. XC: Conceptualisation, Writing-review & editing, Supervision, Methodology, Formal analysis. QB: Writing-review & editing, Supervision, Methodology, Formal analysis. JH: Writing-review & editing, Supervision, Methodology, Formal analysis. PJ: Writing-review & editing, Supervision, Methodology, Formal analysis. NZ: Conceptualisation, Writing-review & editing, Supervision, Validation, Methodology, Formal analysis, Project administration. MK: Conceptualisation, Writing-review & editing, Supervision, Validation, Methodology, Formal analysis, Project administration.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Tables

Table 1. Baseline Characteristics of Participants.

Characteristic	OD (M±SD)
Gender, number (%)	
Male	29 (50%)
Female	29 (50%)
Age (years)	23.10±2.10

M, Mean; SD, Standard deviation.

Table 2. Changes in Intraocular Pressure and Vital Sign-Related Physiological Indicators Before and After Intervention.

	SCAEE				SAEE			
	Before (M±SD)	After (M±SD)	Δ (M±SD)	P	Before (M±SD)	After (M±SD)	Δ (M±SD)	P
IOP (mmHg)	16.10±3.43	14.49±3.15	-1.61±1.20	0.001	15.36±3.18	14.67±3.13	-0.68±2.16	0.019
PD (mm)	5.23±0.81	5.04±0.83	-0.19±0.35	0.001	5.16±0.75	5.07±0.77	-0.09±0.37	0.058
SBP (mmHg)	111.78±16.79	108.00±16.12	-3.78±7.16	0.001	109.14±16.23	105.53±14.91	-3.60±5.95	0.001
DBP (mmHg)	70.74±11.05	68.40±10.40	-2.34±5.39	0.002	68.72±11.67	66.52±10.71	-2.21±6.18	0.009
HR (bpm)	73.66±11.11	72.16±11.87	-1.50±7.34	0.047	71.69±11.72	71.31±11.95	-0.38±6.24	0.366

IOP, Intraocular pressure; PD, Pupil diameter; SBP, Systolic blood pressure; DBP, Diastolic blood pressure; HR, Heart rate; Δ, Change value before and after intervention; SCAEE, standard Chinese acupoint eye exercise; SAEE, sham acupoint eye exercise; M, Mean; SD, Standard deviation. Data were analyzed using paired-sample t-test, or Wilcoxon signed-rank test for non-normal distributions.

Table 3. Changes in Schlemm's canal, and trabecular meshwork before and after intervention.

		SCAEE				SAEE			
		Before (M±SD)	After (M±SD)	Δ (M±SD)	P	Before (M±SD)	After (M±SD)	Δ (M±SD)	P
SC diameter (mm)	T	0.199±0.062	0.242±0.077	0.043±0.059	0.001	0.232±0.062	0.220±0.063	-0.012±0.046	0.046
	N	0.207±0.057	0.245±0.067	0.037±0.062	0.001	0.216±0.067	0.231±0.070	0.014±0.066	0.102
SC area (mm ²)	T	0.006±0.002	0.008±0.003	0.002±0.003	0.001	0.007±0.002	0.007±0.002	-0.000±0.002	0.440
	N	0.006±0.002	0.007±0.003	0.001±0.002	0.001	0.006±0.002	0.007±0.003	0.000±0.003	0.381
TM width (mm)	T	0.605±0.102	0.626±0.096	0.021±0.038	0.001	0.611±0.097	0.603±0.088	-0.007±0.052	0.283
	N	0.623±0.100	0.642±0.095	0.019±0.044	0.001	0.623±0.082	0.612±0.081	-0.011±0.049	0.208
TM thickness (mm)	T	0.116±0.041	0.112±0.044	-0.004±0.030	0.290	0.108±0.033	0.111±0.029	0.003±0.024	0.331
	N	0.129±0.058	0.123±0.059	-0.006±0.040	0.013	0.117±0.043	0.121±0.050	0.004±0.028	0.619

SC, Schlemm's canal; TM, Trabecular meshwork; T, Temporal; N, Nasal; Δ, Change value before and after intervention; SCAEE, standard Chinese acupoint eye exercise; SAEE, sham acupoint eye exercise; M, Mean; SD, Standard deviation. Data were analyzed using paired-sample t-test, or Wilcoxon signed-rank test for non-normal distributions.

Table 4 Intergroup comparison of intraocular pressure, autonomic nervous activity parameters, and aqueous humor outflow pathway indices between the two groups

Parameter	SCAEE (M±SD)	SAEE (M±SD)	P
IOP (mmHg)	-1.61±1.20	-0.68±2.16	0.002
PD (mm)	-0.19±0.35	-0.09±0.37	0.144
SBP (mmHg)	-3.78±7.16	-3.60±5.95	0.888
DBP (mmHg)	-2.34±5.39	-2.21±6.18	0.898
HR (bpm)	-1.50±7.34	-0.38±6.24	0.381
Temporal SC diameter (mm)	0.043±0.059	-0.012±0.046	<0.001
Nasal SC diameter (mm)	0.037±0.062	0.014±0.066	0.054
Temporal SC area (mm ²)	0.002±0.003	-0.000±0.002	<0.001
Nasal SC area (mm ²)	0.001±0.002	0.000±0.003	0.053
Temporal TM width (mm)	0.021±0.038	-0.007±0.052	<0.001
Nasal TM width (mm)	0.019±0.044	-0.011±0.049	<0.001
Temporal TM thickness (mm)	-0.004±0.030	0.003±0.024	0.054
Nasal TM thickness (mm)	-0.006±0.040	0.004±0.028	0.033

SC, Schlemm's canal; TM, Trabecular meshwork; T, Temporal; N, Nasal; SCAEE, standard Chinese acupoint eye exercise; SAEE, sham acupoint eye exercise; M, Mean; SD, Standard deviation. Data were analyzed using an independent samples t-test. Non-normally distributed data were analyzed using the Mann-Whitney U test.

Figures

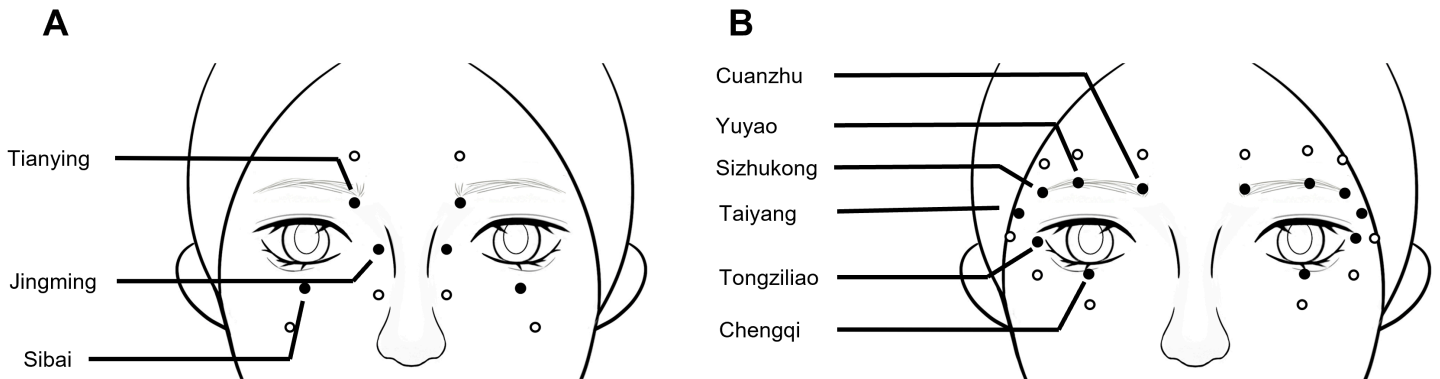


Figure 1

The positions of standard eye exercise acupoints and sham acupoints are indicated by dots and asterisks, respectively. A. The acupoint locations for the first to third segments. B. The acupoint location for the fourth segment. The solid dots represent standard acupoints and the hollow circles denote sham acupoints.

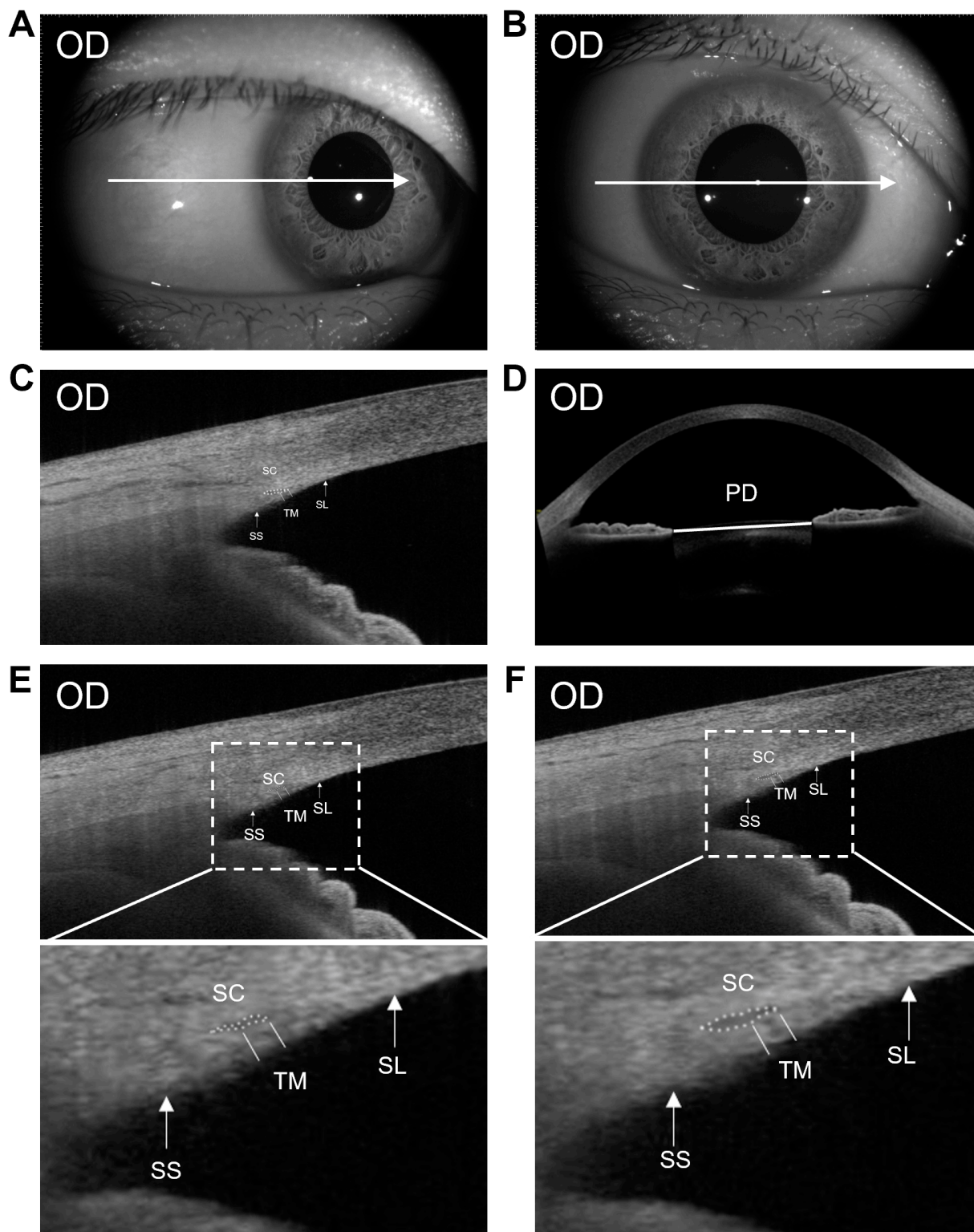


Figure 2

SS-AS-OCT images of the participants. A. The right eye of a participant looking nasally. B. The participant looks straight ahead. C. SS-AS-OCT image of Schlemm's canal and trabecular meshwork obtained when the participant looks nasally. D. SS-AS-OCT image of pupil diameter obtained when the participant looks straight ahead. E. SS-AS-OCT image of the temporal region before acupoint massage. F. SS-AS-OCT image of the temporal region after acupoint massage. SL, Schwalbe line; SS, Sclera spur; SC, Schlemm's canal; TM, Trabecular meshwork; PD, Pupil diameter.

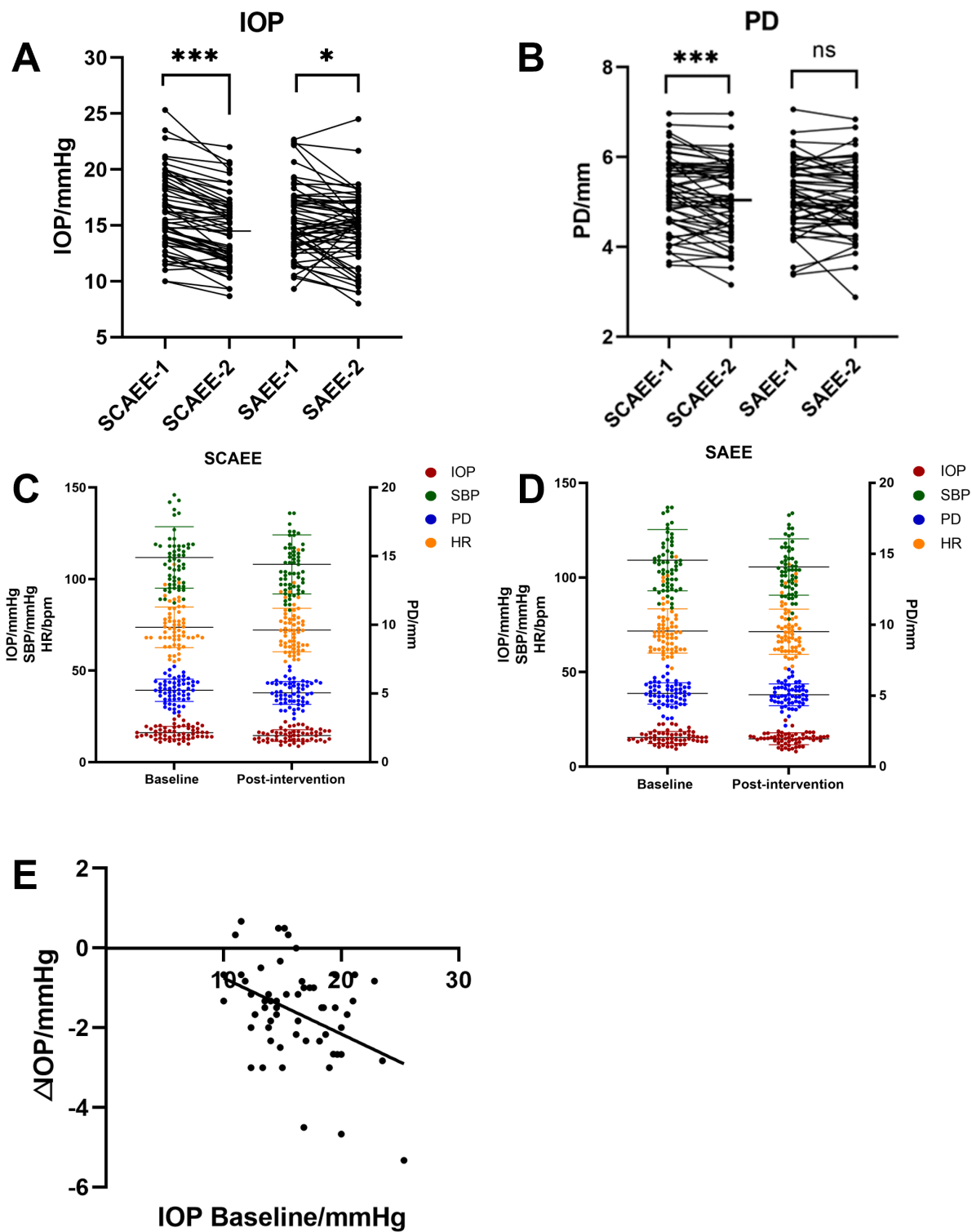


Figure 3

Changes in intraocular pressure and autonomic nervous activity indicators before and after the intervention. A. Changes in intraocular pressure in the SCAEE group and SAAE group before and after the intervention. B. Changes in pupil diameter in the SCAEE group and SAAE group before and after the intervention. C. Changes in intraocular pressure and autonomic nervous activity indicators in the SCAEE group. D. Changes in intraocular pressure and autonomic nervous activity indicators in the SAAE group. E. Scatter plot of initial intraocular pressure and the amount of change in intraocular pressure after acupoint massage. IOP, Intraocular pressure; ΔIOP , The amount of change in intraocular pressure; PD, Pupil diameter; SCAEE, standard Chinese acupoint eye exercise; SAAE, sham acupoint eye exercise. Data were analyzed using paired-sample t-test, or Wilcoxon signed-rank test for non-normal distributions. ns $P \geq 0.05$, * $P < 0.05$, *** $P < 0.001$.

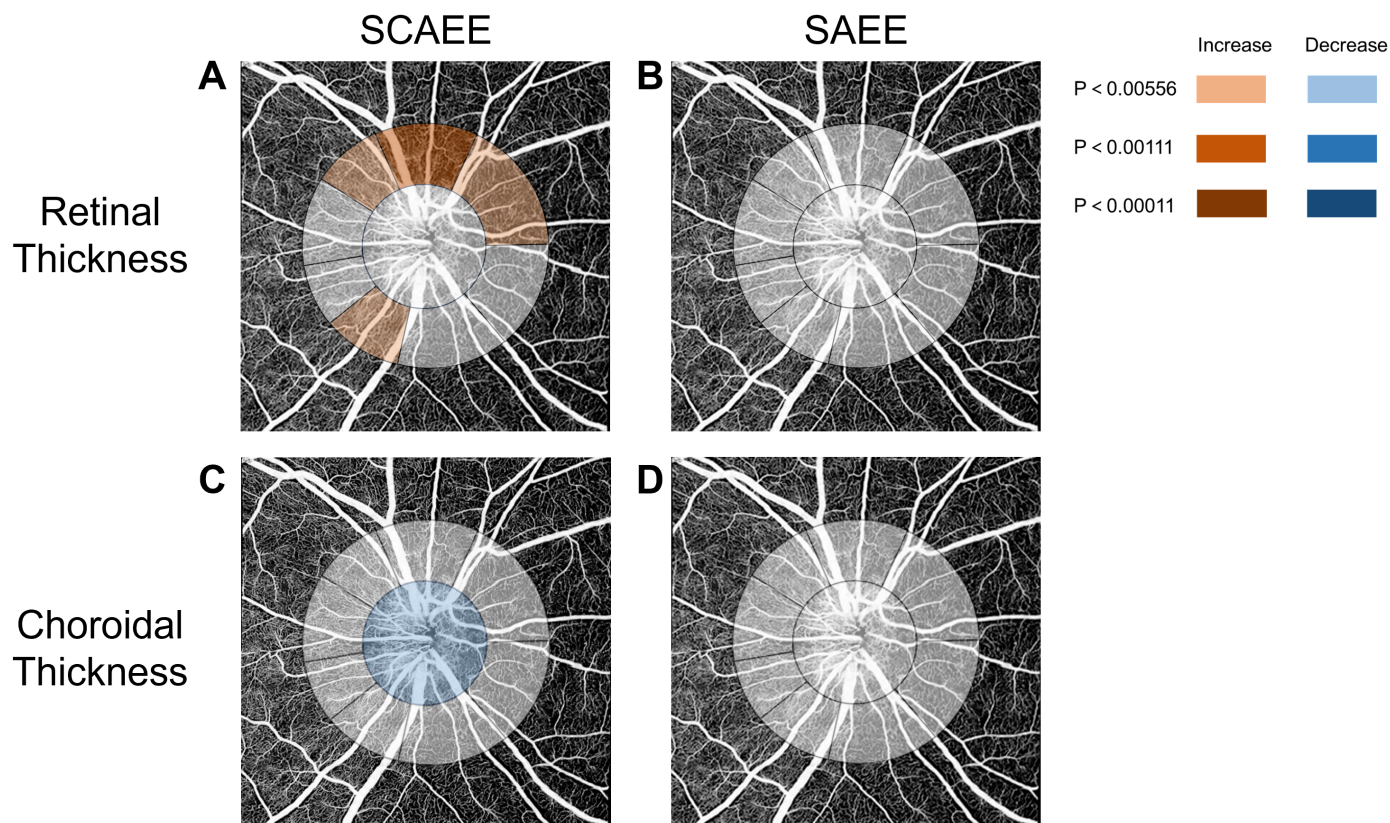


Figure 4

Changes in optic disc blood flow in the SCAEE group and SAE group before and after the intervention. Orange colors indicate a significant increase in the layer, while blue indicates changes in the opposite direction. The shade of the color represents varying degrees of significance for these changes. SCAEE, standard Chinese acupoint eye exercise; SAE, sham acupoint eye exercise. Data were analyzed using paired-sample t-test, or Wilcoxon signed-rank test for non-normal distributions.

Supplementary Files

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- [SupplementarymaterialsTable1.xlsx](#)
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- [SupplementarymaterialsTable3.xlsx](#)
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