• Clinical Research •

Guidelines for preoperative visual function and imaging examination standards in vitreoretinal surgery (2025)

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Abstract

• This guideline seeks to thoroughly investigate the standardized operational procedures for visual function and imaging examinations prior to vitreoretinal surgery. Preoperative assessments can greatly assist clinicians in determining surgical indications, assessing patient conditions, and offering valuable assistance in formulating surgical strategies and predicting outcomes. Developed by a collaborative team of experts from the Ophthalmic Imaging and Intelligent Medicine Branch of the Chinese Medical Education Association, in conjunction with the Ophthalmic Imaging and Intelligent Medicine Branch of the Chinese Medical Education Association, these guidelines have been formulated through extensive research and evaluation, incorporating the latest technological advancements and studies on a global and domestic scale in vitreoretinal surgery. After extensive deliberations and incorporation of up-to-date clinical data, these guidelines have been developed to assist in standardizing preoperative examinations for vitreoretinal surgery. The overarching goals include improving medical quality, maximizing resource allocation, offering decision-making assistance, and safeguarding patient rights. This document provides a comprehensive analysis of preoperative assessments for vitreoretinal procedures, covering principles, methodologies, and precautions related to a range of diagnostic techniques including ultra-wide-angle fundus imaging, fluorescein angiography, indocyanine green angiography, ophthalmic B-ultrasound examinations, ultrasound biomicroscopy, optical coherence tomography, optical coherence tomography angiography, orbital CT scan, orbital MRI, and ophthalmic electrophysiology tests such as electroretinograms, visually evoked potentials, and visual field testing.

• **KEYWORDS:** vitreoretinal surgery; preoperative examination; ultra-widefield fundus imaging; optical coherence tomography; electroretinogram
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INTRODUCTION

Vitreoretinal diseases encompass a range of pathological alterations affecting the vitreous body and retina of the eye, potentially leading to symptoms including reduced

Table 1 Common clinical vitreoretinal diseases and selection of preoperative examination items

Disease category	Preoperative examination items
General (applicable to most vitreoretinal surgery cases)	Vision test, IOP measurement, ultra-widefield fundus imaging, OCT, OCTA
Vitreous diseases	B-scan ultrasound, ultra-widefield fundus imaging, OCT, OCTA, fundus photography
Retinal and choroidal vascular diseases	B-scan ultrasound, ultra-widefield fundus imaging, OCT, OCTA, FFA, ICGA, fundus photography, ERG
Choroidal retinitis	B-scan ultrasound, ultra-widefield fundus imaging, OCT, OCTA, FFA, ICGA, fundus photography
Retinal detachment	B-scan ultrasound, ultra-widefield fundus imaging, OCT, fundus photography
Macular diseases	B-scan ultrasound, ultra-widefield fundus imaging, OCT, OCTA, FFA, ICGA, fundus photography, ERG, multifocal ERG
Retinal changes due to high myopia	OCT, B-scan ultrasound, fundus photography, FFA, ICGA
Intraocular tumors	B-scan ultrasound, color Doppler imaging, ICGA, OCT, orbital CT, orbital MRI, fundus photography
Ocular trauma	UBM, B-scan ultrasound, ultra-widefield fundus imaging, OCT, ERG, VEP
Systemic diseases (*e.g.*, diabetic retinopathy)	FFA, OCT, OCTA, B-scan ultrasound, ultra-widefield photography

ERG: Electroretinogram; FFA: Fluorescein fundus angiography; ICGA: Indocyanine green angiography; IOP: Intraocular pressure; MRI: Magnetic resonance imaging; OCT: Optical coherence tomography; OCTA: OCT angiography; UBM: Ultrasound biomicroscopy; VEP: Visual evoked potential.

visual acuity, ocular discomfort, and visual field loss in patients[1]. Severe cases of these diseases can result in long-term or permanent visual impairment. The vitreous body is a crucial component of the eye's refractive media, while the retina houses photoreceptor cells and serves as the origin of optic nerve impulses, collectively forming the pathway for light to enter the eye. Vitreoretinal surgery, or vitreous surgery, is of significant importance in treating severe vitreoretinal diseases[2]. The primary indications for surgery include primary rhegmatogenous retinal detachment (RD), tractional RD, epiretinal membrane, macular hole, vitreomacular traction syndrome, and other vitreomacular interface diseases that affect vision, vitreous opacities affecting vision, diabetic retinopathy, retinal vein occlusion, subretinal hemorrhage, neovascular glaucoma, and other diseases associated with vitreous hemorrhage and neovascular diseases of the fundus, complications of high myopia related to the vitreoretinal interface, ocular blunt trauma, traumatic vitreous hemorrhage, intraocular foreign bodies, post-traumatic infectious endophthalmitis and other vitreoretinal diseases related to ocular trauma, acute retinal necrosis syndrome, infectious endophthalmitis, ocular toxocariasis and other infectious vitreoretinal diseases, abnormalities in lens position, implantation of artificial vitreous or retinal devices, certain congenital diseases such as retinopathy of prematurity, Coats' disease, familial exudative vitreoretinopathy, vitreous or retinal or choroidal tissue biopsies, and ocular tumors such as retinoblastoma, retinal capillary hemangioma, choroidal melanoma, primary vitreoretinal lymphoma, *etc*. In the management of certain diseases, traditional medication or laser therapies may offer limited efficacy, necessitating surgical intervention. Given the complexity of vitreoretinal surgery, a comprehensive series of preoperative assessments is essential to determine surgical indications, identify contraindications, and tailor a personalized surgical plan based on the individual patient's circumstances. Standardization of preoperative evaluations is imperative in ensuring optimal outcomes. These assessments typically encompass routine tests, general ophthalmic evaluations, and ophthalmic biometry.

The preoperative assessments for vitreoretinal surgery encompass routine preoperative tests, general ophthalmic examinations, ophthalmic biometry and imaging studies, and ophthalmic electrophysiological tests. Standard preoperative assessments typically consist of a comprehensive blood panel, blood chemistry analysis, screenings for infectious diseases such as Hepatitis B, Hepatitis C, syphilis, and human immunodeficiency virus (HIV), evaluation of coagulation function, determination of blood type, blood culture for endophthalmitis, blood pressure monitoring, electrocardiogram, optional 24-hour dynamic electrocardiogram (ECG), echocardiogram, and chest computed tomography (CT) scan for patients electing for general anesthesia. General ophthalmic examinations involve external eye, anterior segment, and fundus examination utilizing slit-lamp, medical optometry (including refractive status, best corrected visual acuity, *etc.*), and evaluations of eye alignment and intraocular pressure (IOP). This guideline lists some common vitreoretinal diseases in clinical practice and the selection of preoperative examination items, as shown in Table 1. In patients undergoing combined cataract extraction and intraocular lens (IOL) implantation, preoperative assessments including corneal endothelial cell count, ocular biometry, and A-scan ultrasonography are essential. These evaluations are extensively covered in specific sections and will not be further detailed in this guideline.

Due to the lack of standardized operational guidelines for preoperative visual function and imaging examinations in vitreoretinal surgery, the Ophthalmic Imaging and Intelligent Medicine Branch and Intelligent Medical Committee of the

Chinese Medical Education Association, in collaboration with the Ophthalmology Committee of the International Association of Translational Medicine, convened a panel of expert writers, refractive experts, and ophthalmic imaging experts to develop the "Guidelines for Preoperative Vision Function and Imaging Examination Standards in Vitreoretinal Surgery (2025)".

This group engaged in comprehensive discussions regarding preoperative visual function and imaging examinations procedures and precautions, integrating clinical practice experience with the theoretical foundations of imaging and electrophysiological examinations. Both in-person and virtual meetings were organized to develop the initial guidelines, with expert group members taking the lead in drafting. Subsequently, experts conducted independent reviews and proposed revisions through email and WeChat. The recommendations were presented to the key members of the guideline development team, synthesized, and deliberated via various communication platforms including WeChat, email, and virtual meetings to thorough consideration of expert input and direction during the revision phase. Following extensive deliberations, the definitive version of the guidelines was formulated.

These guidelines primarily summarize the operational procedure dominantly outline the procedural protocols and clin medical significance of each relevance of individual ophthalmic imaging examination assessments and electrophysiological tests in the preoperative assessment evaluation for vitreoretinal surgery. Ophthalmic imaging examinations include ultra-widefield fundus imaging, fluorescein fundus angiography (FFA), indocyanine green angiography (ICGA), B-mode ultrasound examination, ultrasound biomicroscopy (UBM), optical coherence tomography (OCT), OCT angiography (OCTA), orbital CT, and orbital magnetic resonance imaging (MRI). Ophthalmic electrophysiological tests encompass the electroretinogram (ERG), visual evoked potential (VEP), and visual field testing. The widespread adoption of these guidelines is aimed at standardizextensive implementation of these protocols is intended to establish uniformity preoperative examination assessments for vitreoretinal surgery, providable surgeons with adequate support to assess patient conditions, design operative strategies, and predict to effectively evaluate patient statuses, formulate operative plans, and anticipate surgical prognosticates.

General Ophthalmologic Examination

Slit-lamp examination The utilization of the slit lamp examination, with complemented by its magnification feature and the help of auxiliary equipment such as the gonioscope and three-mirror lens, allows physicians to conduct a detailed inspection of ocular structures capabilities and supplementary tools like the gonioscope and three-mirror lens, facilitates a thorough examination of ocular structures by healthcare professionals (including the eyelids, conjunctiva, cornea, iris, lens, and vitreoretinal components). The slit lamp examination is a crucial tool in preoperative assessment for vitreoretinal surgery, as it assists in evaluating the severity of lesions and determining the need for surgery[3].

Intraocular pressure assessing IOP is essential before surgery, as elevated IOP can indicate various ocular diseases such as retinal vein occlusion, endophthalmitis, and glaucoma. Persistent elevation of IOP has been associated with an increased risk of intraoperative bleeding and irreversible optic nerve damage. Therefore, it is imperative to implement strategies to lower IOP prior to surgery. In instances where retinal detachment or choroidal detachment may result in decreased IOP, and if choroidal detachment is identified through further evaluations, the preoperative use of corticosteroids may be considered to mitigate detachment[4]. This approach is intended to optimize surgical safety and streamline the surgical process.

Medical optometry Medical optometry is a crucial component of preoperative evaluations in ophthalmology, primarily utilized for precise assessment of a patient's visual acuity. It is instrumental in ascertaining the extent of vision impairment prior to surgery and evaluating postoperative visual rehabilitation[5]. Medical optometry enables clinicians to determine the refractive status of the eye, encompassing conditions such as myopia, hyperopia, and astigmatism[6-8]. Furthermore, this process assists in predicting the optimal visual acuity attainable following vitreoretinal surgery, facilitating the establishment of attainable surgical objectives and prognostic anticipations[9-10]. In cases necessitating simultaneous cataract surgery, medical optometry can aid in determining the suitable IOL power to optimize postoperative visual results[11].

Ultra-Widefield Fundus Imaging Ultra-widefield fundus imaging provides detailed retinal images, enabling surgical practitioners to thoroughly evaluate the characteristics and dimensions of fundus lesions. This is essential in establishing the criteria for surgical intervention, encompassing conditions such as retinal tears, RD, retinal degeneration, retinal vascular diseases, and intraocular tumors[12-14]. Through the utilization of this diagnostic modality, healthcare providers can further ascertain any possible ancillary lesions or potential complications, thereby facilitating a more precise formulation of the surgical plan and strategy, ultimately mitigating surgical risks. Moreover, ultra-widefield fundus imaging offers clear visual representations of fundus lesions, facilitating physicians in effectively communicating with patients and improving patient comprehension and compliance. However, there are specific circumstances, such as severe ocular trauma, anterior

segment diseases, vitreous hemorrhage or opacities, and psychiatric conditions affecting cooperation, where ultra-widefield fundus imaging may not be appropriate.

Working principle Ultra-widefield fundus imaging is a technology utilized for capturing comprehensive images of the fundus, extending from the anterior equator to the ora serrata, within a single image. This technique is grounded in laser confocal scanning ophthalmoscopy, which operates on the principle that light emitted from one focal point of an ellipse will reflect off the inner wall of the ellipse and pass through the other focal point. For instance, the Optos ultra-widefield laser scanning ophthalmoscope, a commonly employed device, positions the laser scanning head and the examined eye at the two focal points of an ellipse. By rotating the laser scanner around its conjugate focus, the laser beam is directed into the eye, illuminating up to 80% of the retinal surface (200°) and reaching even the peripheral retina anterior to the vortex veins. The reflected laser beam is then converted by a sensor into high-resolution digital images[15].

The penetration ability of the laser is directly related to its wavelength, with longer wavelengths having greater penetration. Thus, in order to gather information from various layers of the retina, lasers of different wavelengths can be utilized for scanning purposes. A red laser (633 nm) is utilized for imaging from the choroid to the retinal pigment epithelium (RPE), a green laser (532 nm) is employed for autofluorescence imaging from the RPE to the neuroepithelial layer, and a blue laser (488 nm) is employed to excite fluorescein for ultra-widefield fluorescein angiography images of the fundus.

Operating procedure, taking Optos ultra-widefield scanning laser ophthalmoscope as an example

1) Preparation Initiate the process by recording the pertinent patient-specific data. Subsequently, based on the evaluation criteria, choose the suitable ultra-widefield retinal imaging mode, inclusive of ultra-widefield color retinal images, ultra-widefield autofluorescence retinal images, and ultra-widefield fluorescein angiography retinal images. Prior to undergoing ultra-widefield fluorescein angiography, it is recommended to conduct a precautionary skin test to identify individuals who may be sensitive to the contrast agent and should therefore avoid this evaluation.

Confirm that the patient is positioned comfortably and adjust the equipment's height to align appropriately with the patient's eye level. Direct the patient to maintain both eyes open and gaze straight ahead during the procedure. If patient cooperation is inadequate, gentle manipulation of the eyelid or use of an eyelid opener may be necessary to achieve optimal exposure.

2) Ultra-widefield color retinal images and ultra-widefield autofluorescence retinal images Adjust the patient's head position until the green circle aligns with the sclerocorneal junction, indicating proper alignment for image capture. The pupil's center should manifest as a solid green circle at this juncture, enabling you to proceed with the capture. In cases of artificial lens implants or silicone oil-filled eyes, slight adjustments to focal length may be required to capture the image when a red subtractive sign or solid red circle is present.

3) Ultra-widefield fluorescein angiography retinal images Align the capture lens accurately with the eye being examined and promptly administer the sodium fluorescein solution/ indocyanine green into the antecubital vein within a four to five-second timeframe, contingent upon starting the timer. In the early stage (within the first minute) of the examination, initiate automatic capture approximately five seconds after the retinal blood vessels begin to be outlined. Once the veins in the primary examination eye are fully saturated (between 30-45s), proceed to capture the image of the contralateral eye. Intermediate images should be captured at the 5-minute mark (between 1-10min), with late-stage images taken at the 10-minute mark (between 10-15min).

4) Image quality evaluation and preservation An optimal ultra-widefield retinal image should demonstrate clear delineation and extensive coverage, effectively capturing key anatomical features such as the optic disc, macula, and vortex veins while mitigating obstruction from eyelids or eyelashes to maintain a field of view obstruction of less than 10°. Following image acquisition, promptly export and store the images in a high-resolution format.

Precautions 1) In order to achieve a more comprehensive visualization of the fundus imagery, patients may be instructed to adjust their gaze to enable the acquisition of multiple images that can later be stitched together to create a detailed panorama. 2) It is crucial to obtain ultra-widefield color retinal images and autofluorescence images before administering any contrast agent. 3) Prior to initiating the acquisition of ultra-widefield fluorescein retinal angiography images, it is imperative to consult with the prescribing physician to confirm the eye under primary scrutiny for the examination. 4) During ICGA, it is imperative to include an additional step of capturing images of both eyes at the 20-minute mark. 5) If it is determined that the contrast examination cannot be performed, OCTA can be selected as an alternative examination.

Fluorescein Fundus Angiography Fundofluorlithography, including FFA and ICGA, is a widely used imaging technique in the assisted diagnosis of retinal and choroidal diseases, involving the intravenous injection of dye agents such as fluorescein sodium or indocyanine green[16]. The dye is introduced intravenously and travels through the circulatory system to the retinal and choroidal vessels, where it is stimulated by a specific wavelength of light, resulting in fluorescence of the dye molecules. Subsequent use of

specialized filters enables the selective detection of the emitted light, facilitating the acquisition of detailed angiographic images of the fundus vasculature.

FFA enables comprehensive evaluation of vascular occlusions, abnormal neovascularization, microangiopathies, and other retinal or macular lesions in terms of location and extent. This information aids physicians in determining the pathophysiology and progression of the disease, facilitating the selection of the most suitable laser treatment or surgical approach based on the location of neovascularization and the extent of tissue involvement. For patients necessitating extended monitoring, such as those afflicted with diabetic retinopathy[17-18] or age-related macular degeneration, routine FFA can effectively track disease progression, facilitating timely adjustments to treatment plans for optimal therapeutic results. The visual representation of angiographic images can aid physicians in elucidating the disease to patients, thereby bolstering patient engagement and compliance with treatment protocols.

FFA dynamically observes the morphology of retinal blood vessels, which is of great value for the diagnosis of retinopathy, but deep choroidal vascular lesions (especially choroidal neovascular disease) may not be well visualized in FFA. In this cases supplementary evaluations such as indocyanine green angiography may be warranted[19].

Contraindications 1) Individuals with a documented allergy to fluorescein solution/indocyanine green; 2) Individuals with severe renal insufficiency; 3) Individuals with unstable vital signs; 4) Patients whose glaucoma is not suitable for dilated eyes; 5) Patients with hypertension should undergo psychological intervention before angiography to help patients relax, and control and detect their blood pressure.

Working principle During FFA, sodium fluorescein emits yellow fluorescence within the wavelength range of 520 to 530 nm when stimulated by light between 465 to 490 nm. This emitted fluorescence is detected by a sensor incorporating a yellow-green filter, and subsequently converted into an image for documentation. Indocyanine green exhibits peak absorption and fluorescence wavelengths at 805 and 835 nm, respectively, situated within the near-infrared region of the electromagnetic spectrum[20].

Examination procedure

1) Preparation Prior to the angiographic examination, a thorough evaluation of the patient's medical history is essential to identify any contraindications. Informed consent for the procedure will be obtained from the patient, who will also undergo a sodium fluorescein/indocyanine green skin test.

Assessment of the anterior chamber, angle of the anterior chamber, and degree of refraction is imperative for proper evaluation of the patient's ocular health. Pupil dilation should be initiated to achieve a pupil diameter exceeding 5.5 mm. Utilization of the small pupil mode for photography is recommended when the pupil diameter falls between 4.0 and 5.5 mm. However, obtaining clear fundus photographs may be difficult if the pupil diameter is less than 3.3 mm. In cases where patient cooperation is limited, the use of topical anesthetic may be considered for assistance.

Subsequently, patient information should be recorded, and the patient should be instructed to assume a seated position while adjusting the height of the lifting platform and chin rest accordingly. Instruct the patient to position their chin on the chin rest and gently lean their forehead against the forehead rest.

2) Injections of dye Align the camera lens with the patient's eye and optimize refraction and brightness settings to capture a clear infrared image of the fundus. Promptly inform the nurse to administer the sodium fluorescein dye solution into the antecubital vein within 4 to 5s upon initiating the timer.

The recommended dosage of sodium fluorescein is 10 mg/kg. For adults, the choice between a 5 mL solution at a 10% concentration or a 3 mL solution at a 20% concentration is available, while for pediatric patients, the dosage should be determined based on body weight. Patients with severe renal insufficiency undergoing fundus fluorescein angiography should receive a reduced dose accordingly. The recommended dosage for indocyanine green ranges from 25-50 mg or 1-2 mg/kg[20].

3) Early stage After the initiation of retinal blood vessel filling, typically occurring 5 to 10s post-injection, it is recommended to commence capturing images of the eye under examination, with a focus on the macula. Utilizing an interval of 1 to 2s, a series of 5 to 8 photographs should be taken over a duration of 40 to 45s.

4) Medium stage Following the completion of the injection, approximately one to one and a half minutes later, images of the eye under evaluation should be obtained, with specific attention to the macula and optic disc. After two minutes following the injection, use the fixation lamp to guide the patient's gaze. In sequence, capture images focusing on the temporal side of the macula (with the macula located at the nasal edge of the image), the upper temporal area (where the bottom edge of the image is tangent to the top of the optic disc, with the nasal edge passing through the center of the optic disc), the lower temporal area (where the top of the image is tangent with the lower edge of the optic disc, and the nasal edge passes through the optic disc center), the upper nasal area (where the bottom edge of the image is tangent to the optic disc's upper edge, and the temporal edge passes through the center of the optic disc) and the lower nasal area (where the top edge of the image is tangent to the bottom edge of the optic disc, and the temporal edge passes through the optic disc center).

After completing imaging of the primary eye under examination, analogous images should be obtained for the contralateral eye.

5) Late stage Photographs focusing on the macula of the eye under examination should be taken at five and ten minutes post-injection. It is recommended to initiate the imaging process with the primary eye under examination before proceeding to the opposite eye.

6) Image quality assessment and storage Subsequently, the captured images should be exported and saved at their original resolution to maintain image quality.

7) Patient education post dye a) The patient should be monitored for a duration of 30min, with particular focus on their overall condition. Symptomatic treatment should be administered to individuals displaying allergic reactions, while those experiencing anaphylactic shock should be closely observed until their vital signs normalize. b) Patients should be advised to consume ample amounts of water on the day of the examination. Sodium fluorescein typically exits the body within a 24-hour period, with temporary discoloration of bodily fluids and tissues, such as urine, sweat, and eyes, being a common occurrence. c) Following the examination, it is advisable for the patient to refrain from engaging in activities that are considered hazardous or require precision, such as driving, for the remainder of the day. d) After the FFA examination, it is advisable to refrain from performing colorimetry-based laboratory tests, including serum creatinine, total protein, and cortisol[21]. Additionally, it is important to note that ICGA may interfere with the thyroid radioactive iodine uptake test, therefore it is recommended to allow a minimum interval of one week between these tests. e) For pregnant and lactating women, nursing mothers should cease breastfeeding for a period of 24h. In cases where newborns are undergoing phototherapy, breastfeeding should be halted for a minimum of 72h. Any milk expressed during the cessation of breastfeeding should be discarded.

Precautions 1) The examination should be conducted with maximum pupil dilation. In cases where patients have a shallow anterior chamber or narrow angle, it is crucial to induce pupillary constriction post-examination to prevent the onset of acute angle-closure glaucoma. Additionally, for eyes with significant refractive errors, the device's built-in refractive settings can be customized accordingly. 2) In patients with renal impairment, a lower dosage of sodium fluorescein may result in a decreased vascular filling time, requiring prompt all images acquisition in early stages. For instance, an image obtained 5min post-injection of a 2 mL 10% solution is comparable to an image acquired 15min after administering a 5 mL 10% solution[22]. 3) In cases where a patient may be at risk of hypersensitivity reactions during fluorescein angiography, it is essential for emergency medical personnel to be present during the imaging process, as deemed necessary by the clinician after a thorough assessment of the benefits and risks. 4) In the event of extravasation during dye administration, immediately cessation of infusion and application of local pressure are recommended. Sodium fluorescein might have entered the blood vessels in certain instances, thus allowing for attempted image capture. 5) The initial images should prioritize the primary eye under examination while also taking into account both eyes. 6) The reported incidence rate of complications associated with FFA ranges from 1.1% to 4.4%. Adverse reactions may include symptoms such as nausea, vomiting, and pruritus, typically resolving within 1.5h. In instances of severity, shock or fatality may ensue[23]. Hence, it is imperative to closely monitor the patient's overall condition throughout the procedure. If notable distress is observed, the shooting should cease promptly. Depending on the circumstances, the patient may be allowed to rest or receive additional treatment, and the shooting may resume following the patient's recovery. 7) The utility of ultra-widefield angiography lies in its capacity to reveal distant peripheral retinal abnormalities, proving particularly beneficial for cases of extensive or peripheral retinal disorders. (such as familial exudative vitreoretinopathy, diabetic retinopathy, *etc*.). Therefore, it is imperative for physicians to carefully consider the clinical requirements and individual patient circumstances when choosing ultra-widefield angiography for preoperative assessments and postoperative monitoring.

Ophthalmic Ultrasound B-scan The utility of B-scan ultrasound examination is primarily determined by the penetration depth of the ultrasound beam, making it less susceptible to the effects of refractive media and allowing for a broad range of applications in the diagnosis of vitreous, retinal, and choroidal pathologies. It can help to assess whether there is a retinal detachment or even a choroidal detachment, the extent of the detachment, and whether there is fluid accumulation under the retina. In case of opacity of refractive media such as corneal diseases, cataract opacity or dislocation, as well as vitreous hemorrhage, where traditional ophthalmoscopy and fundus photography are unable to visualize intraocular structures, B-scan ultrasound can serve as a valuable tool. It can effectively penetrate the opaque media to provide valuable information for evaluating orbital and intraocular space-occupying lesions, including their location, nature, and size. Additionally, B-scan ultrasound is utilized in cases of ocular trauma, intraocular foreign bodies, and intraocular inflammation to assess the extent of injury and the presence of residual foreign material[24-26].

A significant differentiation between ultrasound B-scan and CT or MRI lies in their imaging capabilities, with the former

offering cross-sectional images from multiple angles compared to the primarily transverse cross-sections and reconstructed coronal and sagittal planes provided by the latter two modalities. This enhanced imaging capability of ultrasound allows for a more thorough and precise assessment of abnormal structures or lesions, providing valuable three-dimensional (3D) information that aids in the comprehension of structural shape and relationships. Standardized, the establishment of standardized and universally accepted scanning protocols for cross-sections and angles is imperative.

In contrast to other diagnostic procedures, ophthalmic ultrasound typically lacks clear contraindications. Nevertheless, in cases of severe ocular trauma or conditions that may predispose to globe rupture, caution is imperative during the examination to prevent exacerbation of the condition. Care should be taken to avoid excessive pressure on the eyeball.

Working principle Ultrasound waves encounter varying degrees of reflection as they traverse different tissue interfaces within the human body, attributable to differences in acoustic impedance at these interfaces. A portion of the reflected waves is subsequently captured by the ultrasound probe. The transducer housed within the probe converts these signals into discernible waveforms or images, thereby generating a visual depiction of the internal anatomical features[27].

Basic sections of B-scan ultrasound The performance of the ultrasound image is contingent upon the scanning position, probe placement, and orientation of the beam scanning plane. The fundamental ultrasonic examination techniques for intraocular diseases encompass transverse, longitudinal, and axial scanning. Transverse and longitudinal scanning techniques are employed to circumvent lens interference and minimize attenuation caused by the lens on the ultrasound waves.

1) Transverse scanning The orientation of the probe label is aligned parallel to the limbus, with the transverse scan generating a meridian cross-section opposite to the probe's position. Depending on the position of the probe, the transverse scan can also be divided into horizontal transverse scanning (probe label pointing to the nasal side, probe locates at 6/12 o'clock limbus), vertical transverse scanning (label pointing upward, probe locates at 3/9 o'clock limbus), and oblique transverse scanning (label pointing upward, probe locates at the 1:30, 4:30, 7:30, and 10:30 limbus).

2) Longitudinal scanning The probe's mark direction is perpendicular to the limbus. The proximity of the probe to the limbus affects the clarity of the posterior pole image, with closer proximity resulting in clearer images. Conversely, positioning the probe closer to the dome yields clearer images of the anterior segment.

3) Axial scanning Axial scanning entails placing the probe at the corneal center and directing the sound wave through the lens center. This scanning technique is primarily utilized for evaluating and diagnosing diseases related to the lens, optic nerve, and macula.

Precautions 1) Patients with gas-filled vitreous cavities should undergo examination in a seated position. In cases of silicone oil filling, patients may be classified as either fully filled or partially filled depending on the quantity of silicone oil present. B-scan images of fully filled eyes exhibit minimal variation across different body positions. Conversely, in cases of partial filling, a distinct arc-shaped strong echo may be observed between the silicone oil and the retina in the supine position, while two distinct-sized echoes from the ocular wall may be visible in the seated position. Due to the higher sound attenuation in silicone oil compared to vitreous humor, as well as the pseudo-enlargement of the vitreous cavity volume and increased axial length in silicone oil-filled eyes, there is often difficulty in probing the posterior segment at standard detection depths. Therefore, when conducting a B-scan on a silicone oil-filled eye, it is advisable to increase the detection depth. 2) For patients with trauma or post-surgery, it is important to move caution and gentleness during movements to prevent exacerbating pain or causing further damage. 3) In cases where bleeding, inflammation, or alterations to the eye wall are observed, it is advisable to enhance the ultrasonic intensity and perform multi-sectional, multi-angle examinations of the affected region. 4) Color Doppler imaging can effectively visualize the velocity and direction of blood flow in the ocular vasculature, providing valuable diagnostic information for identifying vascular occlusion, diminished blood flow, or other circulatory abnormalities. In specific circumstances, particularly during emergencies or in environments lacking advanced medical equipment for FFA, ICGA, or OCTA examinations, color Doppler imaging continues to be a valuable diagnostic tool. It can supplement other advanced fundus imaging technologies or offer crucial clinical information in their absence. Nevertheless, color Doppler imaging is not a substitute for FFA, ICGA, or OCTA, as these modalities provide superior sensitivity and resolution in identifying fundus pathologies, especially in detecting microvascular abnormalities. 5) Elastography may offer valuable insights for the qualitative diagnosis of intraocular tumors[28].

Ultrasound Biomicroscopy UBM employs high-frequency ultrasonic waves to generate detailed images of the anterior segment of the eye, allowing for thorough examinations of structures such as the lens, iris, cornea, anterior chamber, ciliary body, and chamber angle. This technique is particularly beneficial for patients who are not suitable for traditional examination methods due to opacification of transparent media or inadequate pupillary dilation. Due to its limited ability

to penetrate deeper ocular structures, UBM is not typically utilized for direct assessment of the vitreous, retina, or choroid. However, UBM can be beneficial in preoperative evaluations for vitreoretinal surgery in specific scenarios such as lens malposition, zonular dialysis, tumors, or extensive peripheral inflammation[26,29-30]. The use of UBM to assess chamber angle structures and their openness can aid in surgical planning and postoperative care. By taking into account the individual patient's unique medical condition and the possibility of complications, UBM has the potential to offer a more comprehensive diagnostic evaluation.

OCT and OCTA OCT functions as a rapid, non-invasive, and repeatable imaging technique that provides detailed images of the retina and macula with high resolution. This technology allows for precise identification of the scope and seriousness of pathological changes, aiding in the determination of the type, location, and severity of the patient's condition. OCT is suitable for a variety of macular and retinal disorders, such as RD, retinal tear, macular edema, epiretinal membrane, diabetic retinopathy, and retinal vein obstruction[31-32].

Utilizing OCT imaging to examine the relationship between the vitreous body and retina can be beneficial in formulating a suitable treatment strategy and evaluating postoperative prognosis. Performing an OCT assessment prior to vitreoretinal surgery can serve as a foundational reference point. Through a comparison of meticulously obtained preoperative and postoperative OCT scans, clinicians can evaluate whether the surgery has achieved the anticipated outcomes[33-34].

OCTA is a non-invasive eye imaging technique that utilizes the principles of OCT to capture blood flow information at the retina and choroid levels. Compared to traditional dye-based angiography methods such as FFA and ICGA, OCTA offers the benefit of avoiding complications associated with dye injection, such as allergic reactions or subcutaneous hemorrhage. By analyzing changes in the reflected light waves from a sample in real-time, it is able to detect blood flow dynamics and produce high-resolution images of the vascular network of the retina and choroid. This technique enables physicians to accurately diagnose and track various diseases, including age-related macular degeneration, polypoidal choroidal vasculopathy, central serous chorioretinopathy, pathological myopia, diabetic retinopathy, retinal vein occlusion, and intraocular tumors such as retinal hemangioblastoma, choroidal osteoma, and choroidal melanoma, among others, without the necessity of dye injection[12,14,35-38].

In contrast to traditional imaging modalities such as FFA and ICGA, OCTA offers distinct advantages including its non-invasive nature, which eliminates the risks associated with dye injection, and its ability to facilitate multiple repeat examinations within a short timeframe for continuous disease progression tracking. The assessment process is expeditious, typically concluding within a few minutes, whereas traditional methods like FFA/ICGA would still be pending the circulation of dye within the eye. Additionally, OCTA's high-resolution imaging capabilities, leveraging coherence properties of light waves to directly detect signal changes induced by blood flow alterations, enable detailed visualization of fine vascular structures.

However, it is important to acknowledge that OCTA also presents certain limitations. The limitations of OCT in detecting vessel leakage, particularly in conditions such as retinal vein occlusion, its inferior penetration compared to ICGA for choroidal imaging, and its high cost and need for specialized detection equipment restrict its widespread utilization in certain regions. Therefore, the selection of an angiography technique should be informed by a thorough evaluation of the particular condition and the accessibility of equipment.

Working principle OCT employs a low coherence light source, splitting the light beam into two. One part of the light beam is directed into the eye being examined, while the other part is directed into a reference mirror. As a result of tissue reflection and absorption, changes in phase and amplitude occur following the reflection of the two light beams. The reflected scattered light beam and the reference light beam encounter in the interferometer, and the interference signal is processed by the system to produce OCT images[39].

Based on variations in imaging methodology, OCT can be classified into time-domain OCT (TD-OCT) and Fourier-domain OCT. Fourier-domain OCT, based on different spectral detection mechanisms, can further be divided into spectral-domain OCT (SD-OCT) and swept source OCT (SS-OCT).

TD-OCT: TD-OCT employs time-domain signal acquisition to adjust the path difference of the reference light, scanning gradually to capture depth information at various positions. The depth information of the reflective signal is obtained at each scanning position by measuring the phase shift between the reference light beam and the scattered light beam. Cross-sectional images are generated through Fourier transformation of these signals[40].

SD-OCT: SD-OCT employs frequency-domain signal acquisition by decomposing the light signal into various frequency components through spectral analysis. This enables the simultaneous measurement of frequency component signals, facilitating the collection of depth information at all positions concurrently. The primary benefit of SD-OCT is its capability for high-speed imaging, yielding real-time, high-quality images[41].

SS-OCT: SS-OCT uses full-spectrum signal acquisition to measure the reflected spectra by simultaneously capturing

all wavelengths of light signals. In contrast to SD-OCT, SS-OCT eliminates the need for spectral analysis and is capable of directly capturing information from reflected spectra. SS-OCT is distinguished by its superior signal-to-noise ratio and rapid imaging capabilities[42].

Various scanning schemes, such as radial scanning, 3D scanning, and raster scanning, are employed in macular region OCT. Radial scanning involves multiple co-axial line scans, with the axis typically centered on the macular fovea and line scans oriented at a consistent angle with the co-axis. 3D scanning utilizes multiple horizontal line scans to create a rectangular shape, resulting in a reconstructed 3D view. Raster scanning involves a sequence of parallel line scans. This scanning method can be performed at varying angles and offers enhanced resolution.

Examination procedure, take the Heidelberg OCT as an example

1) Preparation It is recommended that patients have pupils with a minimum diameter of 3 mm. The elevation of the chin rest and operator's table should be adjusted to an optimal height, and patients should be instructed to sit with their chin resting on the chin rest and their forehead against the forehead strap. Patients should be guided to focus on a fixation light, which may be integrated into the equipment or external. Choose the suitable scanning technique for visualizing the specific area of the retina and capturing real-time OCT images. Adjust the operational handle to optimize the image quality, adjust refraction and brightness settings to enhance the clarity of the infrared fundus image.

2) Standard mode Access the image overlay photography interface, conduct horizontal and vertical scans of the macular region, and examine for any abnormalities. Upon completion of the overlay process, save the horizontal and vertical images passing through the fovea of the macula, along with images of any identified lesions.

3) Blood flow mode Access the image overlay photography interface and navigate to the OCTA mode. Choose a scanning range of 4.5 and position the scanning frame over the lesion area on the fundus image prior to initiating the scan. Ensure clarity in the dynamic images during scanning by adjusting settings as needed.

4) Enhanced color mode Transition to Enhanced Color mode and optimize refraction and brightness for the clearest infrared fundus image.

5) Finish and print Once scanning is complete, print out the necessary images.

Precautions

1) In the examination of highly myopic eyes, the ultra-long axial mode may be utilized, with the option to shorten the scanning line length as needed. 2) The movement of the fixation light can assist in positioning for capturing OCT images of various areas. 3) When required, dimensions of the image such as distance and area should be measured; for instance, in cases of macular holes, the minimum width at the widest point of the hole should be measured.

Optical CT Although CT imaging is not commonly used as a standard preoperative assessment for vitreoretinal surgery, its indispensable role in clinical diagnosis persists, particularly for the diagnosis and differential diagnosis of conditions such as intraocular tumors, fractures, trauma, foreign bodies, and Terson syndrome[43-44]. Furthermore, CT angiography is better suited for the detection of acute vascular-related ophthalmic emergencies, such as transient blackouts, aneurysms, arterial dissections, and fistulas.

During the preparatory stage of artificial vitreous implant surgery, the utilization of CT scans can aid in precise measurement of ocular dimensions and selection of suitable implant models. In cases of ocular trauma, CT scans are considered the preferred modality for diagnostic imaging, encompassing axial and coronal images as well as 3D reconstructions to ensure a thorough evaluation.

Orbital CT considerations 1) Artifacts stemming from metal objects and skull bones have the potential to impact the quality of imaging in CT scans. 2) The CT presentation of wooden foreign bodies may be subject to alteration based on fluctuations in water content. Low-density shadows are frequently observed in the early stages following trauma when air content is elevated, with density potentially increasing as water content accumulates over time. When considering the possibility of wooden foreign materials, it is crucial to carefully observe this characteristic and make appropriate adjustments to contrast and tissue window settings to prevent misdiagnosis or overlooking a diagnosis[45]. 3) Fractures of the orbit commonly involve the medial wall and orbital floor due to the presence of the ethmoid and maxillary sinuses. Axial imaging can identify fractures in the medial wall of the orbit, medial displacement of the medial rectus muscle, and herniation of the medial rectus and surrounding soft tissue into the ethmoid sinus; coronal imaging the capability to reveal fractures in the orbital floor, herniation of the inferior rectus muscle and surrounding soft tissue into the maxillary sinus; and 3D reconstructions offer a more detailed visualization of the fracture morphology and the entrapment or herniation of the surrounding soft tissue, aiding in differentiation between blowout fractures and complex fractures of the orbit[46]. 4) Conventional radiography is rarely utilized in ophthalmology due to its limited indications and is therefore not addressed in this guideline. 5) In contrast, CT offers shorter examination times and lower costs compared to MRI. 6) CT scans are contraindicated for pregnant individuals.

Optical MRI MRI, a non-invasive imaging modality, provides detailed anatomical, functional, and metabolic information[47]. While orbital MRI is not typically included in preoperative assessments for vitreoretinal surgery, its importance is heightened in certain situations such as the diagnosis of ocular tumors or Terson's syndrome[44]. Orbital MRI is highly beneficial in assessing the size and exact location of lesions. Despite having slightly lower resolution than CT scans, MRI excels in its ability to differentiate soft tissues, leading to more precise identification of conditions like edema or inflammation in the optic nerve, ocular muscles, and retrobulbar fat tissue[18,48-51]. Consequently, orbital MRI offers valuable preoperative evaluation data for surgeons. Orbital MRI plays a crucial role in guiding surgical interventions by evaluating neural pathways and vascular conditions, ultimately improving the safety and efficacy of the procedure.

The contraindications for orbital MRI include: the presence of non-removable metal objects in the body, such as cardiac pacemakers, artificial joints, metal dentures, metal stents, *etc*.; patients with severe cardiopulmonary dysfunction; and patients with severe mental illness.

It is recommended that orbital MRI examinations incorporate thin-slice scans in both axial and coronal orientations. Following the administration of contrast agents, it is recommended to conduct fat-suppressed T_1 and T_2 weighted imaging in order to enhance the differentiation of retrobulbar fatty tissue. Standard imaging protocols include transverse T_1WI and T_2WI sequences, as well as coronal fat-suppressed T_2WI sequences. In cases where high signal intensity masses are observed on T_1WI sequences, additional transverse fat-suppressed T_1WI sequences should be included. Enhanced MRI should be considered when further characterization of the tumor is needed, with sequence selection typically involving transverse T_1WI and, if deemed necessary, coronal T_1WI. Valsalva maneuver scans: In cases where patients exhibit proptosis upon bending forward and there is suspicion of an orbital varix, it is recommended to initially perform a Valsalva maneuver T_2WI sequence. Subsequently, apply pressure to the neck and proceed with routine scanning.

It is important to prohibit MRI examination in cases where there is a possibility of a metallic foreign body, as the magnetic field may lead to displacement or deformation of the foreign body, potentially resulting in secondary iatrogenic injury[52]. MRI, as opposed to CT, offers the advantage of not involving radiation exposure and providing superior differentiation of soft tissue variations.

Clinical Full-field Electroretinography Visual electrophysiological tests can provide an objective evaluation of a patient's visual function and the integrity of optic nerve transmission. These tests are particularly useful in determining the presence of severe visual impairment and identifying any associated visual function abnormalities in preparation for vitreoretinal surgery. Clinicians can enhance the accuracy of surgical judgments through the utilization of visual electrophysiology tests, which serve as a crucial reference for preoperative planning. In cases where visual electrophysiological test results indicate significant loss or absence of retinal function in a patient, the efficacy of vitreoretinal surgery may be compromised, prompting consideration of alternative treatment options or postponement of surgery. Through the utilization of visual electrophysiology tests, clinicians are able to make preliminary prognostications regarding postoperative recovery, thereby facilitating patient comprehension of anticipated surgical outcomes[53].

ERG is employed for the evaluation of retinal function. ERG can aid in the assessment of retinal dysfunction by monitoring the potential changes in the retina following exposure to flash or pattern stimuli[54]. The stimulation of the retina by light triggers alterations in the photoreceptors, leading to the generation of nerve impulses that are subsequently transmitted through the visual pathway to the cerebral cortex[54]. Visual electrophysiological testing is a non-invasive and objective technique utilized in clinical settings to evaluate the functionality of the retina and optic nerve, as well as to distinguish between genuine visual impairments and feigned blindness. Depending on the equipment and methods, these include full-field electroretinography (fERG), pattern ERG, multifocal electroretinography (mfERG), electro-oculography, and VEP.

Working principle fERG is employed to evaluate the functionality of the complete visual field of the retina in varying light conditions, including dark-adapted (DA) and light-adapted (LA) states. A full-field light stimulator emits a diffuse flash that uniformly illuminates the entire retinal area, while electrodes positioned on the cornea, conjunctiva, or lower eyelid capture the responses to these stimuli.

Operating procedure This guideline adhere to the fERG standards established by the International Society for Clinical Electrophysiology of Vision (ISCEV) in 2022[55].

1) Preparation Patients undergoing this examination have the autonomy to choose whether to dilate their pupils. Nevertheless, it is recommended to measure the pupil diameter both prior to commencement and upon completion of the examination to mitigate the impact of stimulus intensity on result interpretation. Prior to conducting the ERG test, it is advisable to refrain from utilizing intense illumination systems, including indirect ophthalmoscopy, FFA, fundus autofluorescence, fundus photography, and OCT, as well as scleral indentation. If avoidance of these conditions is not possible, it is advised that the patient undergo a recovery

period of at least 30min under indoor lighting conditions prior to the ERG test.

ERG testing procedure may commence with either DA or LA; The critical factor to consider is the adaptation phase preceding the test, with a dark adaptation time of at least 20min before DA and at least 10min before LA were recommended.

Following adaptation, anesthetic eye drops are administered, and electrodes are positioned under subdued red lighting. Record whether the electrodes are installed on the cornea, bulbar conjunctiva, or lower eyelid. The reference electrode is situated on the skin adjacent to the lateral orbital rim or outer canthus for each eye, while the ground (common) electrode is positioned on the forehead, earlobe, or mastoid process.

To mitigate the impact of excessive eye movements and blinking, the patient is instructed to maintain fixation throughout the examination. The fixation target must not impede the process of DA and must remain visible during LA. In cases where the subject is unable to perceive the fixation target, they should be directed to maintain a steady gaze straight ahead.

2) Dark-adapted 0.01 ERG DA 0.01 ERG should be carried out after at least 20min of dark adaptation. For the stimulation, a white flash of 0.01 phot cd/(s·m^2) should be utilized, with a dark intensity approximately 0.025 cd/(s·m^2), and a minimum flash interval of 2s.

3) Dark-adapted 3 ERG DA 3 ERG is performed after the DA 0.01 ERG. Stimulate with a white flash of 3 phot cd/(s·m^2), with dark intensity close to 7.5 cd/(s·m^2), and a minimum flash interval of 10s.

4) Dark-adapted 10 ERG DA 10 ERG is conducted after DA 3 ERG. Stimulate with a white flash of 10 phot cd/(s·m^2), with dark intensity close to 25 cd/(s·m^2), and a minimum flash interval of 20s.

5) Dark-adapted oscillatory potentials DA 3 oscillatory potentials (Ops) and DA 10 Ops can be recorded during DA 3 ERG and DA 10 ERG, respectively, or performed separately. The properties of DA Ops may vary following the initial stimulus or with an extended interval between stimuli, necessitating the recording of data only from the second stimulus of equivalent intensity and frequency or subsequent stimuli.

6) Light-adapted 3 ERG If conducted post-DA, a minimum of 10min of standard whole-field light adaptation at an intensity of 30 cd/m^2 is required; if conducted pre-DA, at least 1min of the aforementioned light adaptation is necessary. The stimulus consists of a single flash of 3 cd/m^2 overlaid on the standard whole-field light adaptation, with a minimum flash interval of 0.5s.

7) Light-adapted 30 Hz ERG The light adaptation conditions for the LA 30 Hz ERG consistent with those of the LA 3 ERG. The sequence in which the LA 3 ERG and LA 30 Hz ERG are conducted is not predetermined. The stimulus involves continuous brief flashes of 3 cd/m^2, each lasting less than 5ms, added to the standard whole-field light adaptation, at a frequency around 30 Hz (27-33 Hz, avoiding multiples of the local power supply line frequency). Fluctuations may be observed at the initiation of the light stimulator; these initial unstable responses can be mitigated by introducing a pause of at least 300ms in between flashes.

Reporting The standard ERG report should include representative waveforms and a curve illustrating the amplitude-time relationship, detailing stimulus variables and the state of dark and light adaptation. Waveforms should incorporate a 20ms baseline preceding the stimulus. The report should indicate the timing and intensity of each flash stimulus, as well as the background luminance. Results and reference values should be provided, along with information on test time, pupil diameter, and electrode placement.

Precautions 1) It is recommended to refrain from measuring impedance post-electrode application to avoid the passage of current through the cornea. 2) While ERG can be utilized in infants and young children, it is advisable to employ pediatric-sized electrodes and meticulously record data pertaining to age, stimulus parameters, compliance, and anesthesia method. The amplitude and waveform of the ERG exhibit variation with developmental stage, eventually reaching adult levels during late infancy and childhood. 3) It is essential to validate reference values for appropriateness within the particular laboratory setting. 4) Research suggests that ERG findings in eyes containing silicone oil may lack accuracy and should be interpreted judiciously[56].

Multifocal Electroretinography mfERG is an electrophysiological assessment that enables simultaneous evaluation of various discrete regions of the retina. This technique is frequently employed to exclude, identify, or characterize impairment in specific retinal regions. The primary objective of mfERG is to offer a topographical assessment of retinal function and is extensively utilized in clinical settings.

In photopic conditions, mfERG is capable of capturing multiple local electroretinogram signals originating from retinal cone cells. Any significant decrease or delay in the N1 and P1 waveforms of mfERG is likely indicative of a pathological process occurring either at or before the level of the bipolar cells. mfERG is commonly utilized for the identification of diseases impacting the functionality of outer retinal cone cells and bipolar cells. It can serve as a valuable tool in the preoperative assessment of specific conditions, such as wet age-related macular degeneration complicated by retinal detachment, vitreous hemorrhage, or submacular hemorrhage,

diabetic retinopathy, hereditary retinal diseases, and severe ocular trauma[57]. The utilization of mfERG assessment enables healthcare professionals to gain a more comprehensive understanding of the functional status of the local retina and its implications for overall visual acuity. This facilitates the development of personalized treatment strategies, the anticipation of surgical results, and the provision of precise preoperative counseling for patients[58].

The mfERG procedure outlined in this guideline adheres to the protocols established by the ISCEV in 2021[57].

Operating procedure

1) Patient positioning Patients are advised to assume a comfortable seated position in front of the screen during the assessment. Physiological artifacts commonly arise from muscle activity, necessitating the importance of ensuring optimal relaxation of the facial and neck muscles; Chin rests and/or forehead supports may be employed to aid in this behavior. In cases of persistent high noise levels, the use of topical anesthetic may be beneficial in enhancing patient comfort and improving the signal-to-noise ratio. When utilizing contact lens electrodes, it is essential to ensure proper alignment with the pupil centered within the corneal electrode ring. The appropriate viewing distance should be adjusted according to screen size to regulate the area of the retina stimulated, known as the visual angle. It is imperative to exercise caution in preventing obstruction of eccentric stimulus elements when utilizing glasses or trial frames.

2) Fixation monitoring The maintenance of stable central fixation is crucial, necessitating vigilant monitoring through available equipment, such as cameras enabling pupil or fundus visualization. In instances where such technology is unavailable, meticulous direct observation is recommended to assess fixation stability. Examination of records and 3D images of patients exhibiting suspected poor fixation, attributed to diminished acuity or lack of cooperation, is advised to identify indications of eccentric fixation.

3) Refraction While there is evidence suggesting that moderate blurring of the retinal image does not significantly impact the mfERG of healthy individuals within a range of ±3 diopters, it is important to prioritize optimal sharpness by considering the patient's accommodative state and adjusting viewing distance accordingly. Lenses can be strategically placed in trial frames or mounts in front of the eyes, with manual adjustments possible on certain commercial instruments. Caution should be exercised to prevent the edges of lenses, trial frames, or mounts from obstructing the field of view of the stimulus and causing noticeable dark spots. Refractive correction exerts an influence on image size, with this impact growing in significance as the magnitude of refractive error escalates. Consequently, maintaining a uniform correction for successive examinations of patients will enhance the ongoing evaluation of medical records.

4) Monocular versus binocular recording If binocular alignment is anticipated, it is possible to record both eyes simultaneously. However, strabismus requires monocular recordings as patients with latent strabismus may not align both eyes to the fixation target. Furthermore, some patients may not maintain sufficient convergence on the stimulus at close range, particularly when pupillary dilation hampers accommodation. In order to identify potential artifacts that require repeated monocular recordings, the traces should be checked.

5) Adaptation a) Pre-exposure: Patients should be situated in standard room lighting conditions prior to the examination. Indirect ophthalmoscopy and fundus photography should be refrained from for a minimum of 15min preceding the mfERG test. In clinical application, it is imperative that the pre-test preparation for all mfERG assessments remains consistent. b) Room lighting: To avoid peripheral dark adaptation and maintain similar photopic levels on the retina, medium or dim room lights should be turned on, and ideally, the lighting should be similar to that emitted by the stimulus screen. It is important to maintain uniform luminance across all recordings, aligning them with control recordings, and to be cautious of any bright light sources or reflections from lens surfaces that may exceed the patient's direct field of view.

6) Recording duration In the context of a 61-element array, it is recommended that the total recording time be a minimum of 4min, while for a 103-element array, the minimum recording time should be 8min. However, experienced laboratories may opt to adjust the duration of recording in order to achieve stable waveforms. The recording time can be segmented into shorter intervals, such as 15-30s, to provide the patient with opportunities to rest between runs and blinks. This segmentation allows for the identification and removal of poor recording segments, which may be affected by noise, movement, blinking, or other artifacts, and enables their repetition without compromising previously collected data.

7) Reporting The mfERG report should include comprehensive data such as waveforms, trace array, and ring averages, as well as measurements of amplitude and peak time. Scene views may be utilized for enhanced comparison with visual fields, while retinal views are more appropriate for comparison with fundus images. These views can be complemented by additional regional averages, 3D maps, and reference ranges. Reports should encompass additional essential details, including the manufacturer of equipment, type of recording electrodes utilized, duration of recording (in m-sequences), scaling of the stimulus array, implementation of spatial averaging, and procedures for artifact correction. Furthermore, it is imperative to provide commentary on potential

Table 2 VEP stimuli according to ISCEV Standards

Type of stimulus	Scale of stimulus	Number of stimuli	Size of stimulus	Average luminance (cd/m^2)	Contrast (%)	Frequency
Pattern reversal	15°	Singles eye	1° (0.8°–1.2°) or 0.25° (0.2°–0.3°)	50 (40–60)	≥80	2 (1.8–2.2) Hz
Image on/off	15°	Singles eye	1° (0.8°–1.2°) or 0.25° (0.2°–0.3°)	50 (40–60)	≥80	1.67 (1.4–1.67) Hz (200ms on; ≥400ms off)
Brief flash	≥20°	Singles eye	≥20°	3 (2.7–3.4)	-	1 (0.9–1.1) Hz

VEP: Visual evoked potentials.

factors that could impact the reliability and interpretation of the recording process, such as patient cooperation, eye movements, head positioning, suboptimal alignment, media opacities, presence of pseudophakia, and inadequate visual correction.

Visual Evoked Potential

Working principle VEP recordings serve as a valuable tool for assessing the electrical potential alterations within the visual cortex in response to flash or pattern stimuli directed at the retina[59]. These recordings offer insights into the functional state of the entire visual pathway, with a particular emphasis on the central visual field. By predominantly processing stimuli from this region, VEPs provide a comprehensive evaluation of the functional integrity of central vision across various levels, including the refractive system, retina, optic nerve, visual pathways, and visual centers VEPs can be utilized by physicians to assist in the localization of lesions within the central visual pathway and to identify additional factors impacting visual function. In cases involving retinal lesions[60], VEP results can aid in the estimation of prognosis[61].

According to the type of stimulus used, VEPs can be categorized into flash visual evoked potentials (FVEP) and pattern visual evoked potentials (PVEP).

Operating procedure This guideline adheres to the VEP standards outlined by the ISCEV in 2016[62].

1) Preparation It is imperative to confirm and input patient data accurately. The VEP examination does not require pupil dilation or constriction, and any alterations in pupil morphology should be documented. Prior to PVEP testing, an optometric assessment is recommended, and optical correction should be made according to the distance from the stimulator. Electrodes should be positioned at specific anatomical landmarks, such as the occipital protuberance (red channel/active electrode) located 1.5-2 cm above, the midpoint of the front hairline (blue channel/reference electrode), and the earlobe (black channel/ground electrode).

There are no specific prerequisites for ambient lighting conditions during the VEP examination; it can be conducted in either dim or illuminated surroundings, with caution taken to shield the patient from intense light sources. It is recommended to help the patient assume a relaxed and stable posture to reduce interference from involuntary muscle movements.

2) Stimuli and measurement Detailed parameters are provided in Table 2. Standard VEP measurements include flash VEP (FVEP) and pattern VEP (PVEP). Pattern reversal involves the presentation of visual stimuli featuring high-contrast black and white checkerboard patterns. The stimuli should alternate between two sizes, 1° and 0.25°. FVEP is elicited by a brief light flash covering a minimum field of view of 20°.

In the context of pattern reversal VEPs, the interval between the stimulus and the maximum VEP deflection is referred to as the peak time. To mitigate potential interference from the stimulator, it is recommended to measure the peak beginning at the midpoint of the stimulus onset.

In the case of pattern on/off VEPs, the waveform typically exhibits three distinct peaks: a positive peak at approximately 75ms, a negative peak at around 125ms, and a subsequent positive peak at approximately 150ms, denoted as C1, C2, and C3, respectively. Amplitude calculations are initiated from the preceding peak in this analysis.

For FVEPs, the waveform is characterized by a sequence of negative (N1, N2) and positive (P1, P2, P3) waves, manifesting as early as 30ms post-stimulus and extending up to 300ms. Typically, the N2 and P2 peaks exhibit greater consistency, with amplitudes being calculated relative to the preceding peak.

It is recommended that each VEP recording undergoes at least two repetitions to ensure data reliability.

3) Completion Remove electrodes, clean the patient's skin and electrodes.

4) VEP procedure for infants The examiner should measure while the child maintains fixation. In order to maintain the child's focus, it may be necessary to have an additional individual engage with the patient while the examiner gathers data. If the child becomes distracted during the assessment, data collection can be temporarily halted until attention is regained. The presence of a family member providing comfort can also facilitate the child's cooperation. While binocular stimulation is a useful tool for evaluating overall visual function, it is advisable to conduct unilateral testing of at least one stimulus type whenever feasible to assess the function of each eye independently. In comparison to PVEPs, FVEPs typically exhibit superior compliance with infants and toddlers. It is crucial to conduct repeated testing in pediatric patients to

ensure the reliability of data and mitigate the impact of artifacts on results.

5) Reporting The report should detail filter settings and the placement of electrodes, including the anode (active electrode), cathode (reference electrode), and ground electrode. The horizontal axis should be labeled in milliseconds (ms), while the vertical axis should be in microvolts (μV), with a positive upward direction recommended. Additionally, the report must provide information on peak times, amplitude measurements, and reference intervals.

Precautions 1) PVEP are recommended for patients who exhibit good cooperation, while FVEP should be considered for patients who struggle to cooperate, often due to visual impairments. 2) Accurate electrode placement is essential for reliable results. 3) The waveform of the VEP is primarily influenced by the frequency of the stimulus, with high-speed frequencies resulting in a sinusoidal waveform, known as the steady-state VEP. 4) VEP testing is typically conducted monocularly to prevent stimuli from reaching the untested eye, necessitating the occlusion of the non-tested eye. It is recommended for laboratories to establish standardization in the size and intensity of flash stimuli, the size of elements in pattern stimuli, their average luminance and contrast, and the frequency of the stimulus. 5) It is important to note that VEP testing should not be used as a substitute for a comprehensive optometric examination.

Visual Field Testing Preoperative visual field examination is a crucial step. This testing offers valuable information into the functional integrity of the retina, assisting healthcare providers in formulating appropriate pre-surgical strategies.

Working principle Visual field testing is primarily performed by measuring the patient's light sensitivity in the peripheral and central areas of their vision. This assessment typically utilizes specialized equipment, such as standard automated static perimeters, to identify any abnormalities or blind spots in the visual field by evaluating the threshold of light perception at various points throughout the patient's field of vision. The findings from this test are utilized to ascertain the degree of vision impairment and pinpoint the specific regions that may be impacting visual function.

Indications Indications for preoperative vitreoretinal surgery visual field examination include: RD necessitates a precise understanding of the extent of detachment for accurate surgical repair; In cases of retinal vascular diseases such as diabetic retinopathy, assessing the extent and severity of retinal ischemia can aid in predicting and documenting retinal function prior to surgery; Macular degeneration, which impacts central vision, benefits from preoperative assessment of the macular region to establish surgical goals and expected outcomes; In instances of vitreous hemorrhage or inflammation, visual field testing can help determine the extent of light transmission blockade and evaluate the degree of visual impairment.

Artificial Intelligence As a cutting-edge science and technology, artificial intelligence (AI) has broad prospects for development in various fields. Deep learning (DL) and machine learning has the superior ability of image recognition and segmentation, in the field of health care, especially highly dependent on imaging diagnosis of fundus disease diagnosis and treatment, it is based on large samples of image recognition, accurate segmentation and data processing can help clinicians improve the accuracy of diagnosis, improve the development of disease, make more standardized evaluation of disease prognosis and make timely adjustment to individualized treatment plan. At present, AI has been deeply involved in the prevention and treatment of ophthalmic diseases, such as diabetic retinopathy, age-related macular degeneration, retinopathy of prematurity, glaucoma, retinal vein occlusion, macular hole, *etc*.

In OCT image analysis based on AI, the neural network structure is used to analyze a large number of samples from different levels, and then find the complex rules behind it, effectively diagnose the abnormal changes of fundus structure, and improve the sensitivity of early screening of eye disease[63]. Current DL systems used for diabetic retinopathy screening include EyeWisdom V1 software, IDx-DR system, RetmarkerDR software, EyeArt system, Google system, and Singapore SERI-NUS system and other[64]. Both the DL model and the support vector machine (SVM) model can distinguish well between healthy eyes and branch retinal vein obstructed eyes. AI can not only diagnose a single eye disease, but also has certain advantages for diagnomultiple eye diseases. In 2017, Ting *et al*[65] showed that the results of using CNN for simultaneous diagnosis of diabetic retinopathy, glaucoma and age-associated macular degeneration had high sensitivity and specificity.

In conclusion, this guideline elucidates the significance of preoperative evaluation in vitreoretinal surgery, emphasizing its role in confirming the essentiality and safety of the procedure, thereby enhancing ocular health outcomes for patients. Furthermore, preoperative assessments serve to mitigate risks and enhance the efficacy of surgical interventions[66].

The primary objective of this guideline is to provide detailed guidance to retinal surgeons, fostering a systematic, standardized, and rigorous approach to preoperative evaluations for vitrectomy and retinal procedures. By following the guidelines provided in this manual, it is expected that healthcare providers will achieve improved time management, increased precision in assessments, and the provision of superior medical care to patients.

It is essential to recognize that while this guideline serves as a valuable reference, it should not be viewed as the sole determining factor. Tailoring individualized diagnosis and treatment plans according to the unique condition of each patient is essential. It is recommended that healthcare professionals conduct comprehensive evaluations and utilize their clinical expertise to make informed decisions, taking into account the individual characteristics of each patient, in order to develop an optimal preoperative examination strategy.

We express our sincere appreciation to the ophthalmic community for their dedicated work and high standards of professionalism. We are confident that through ongoing collaboration and practice, this guideline will continue to evolve and improve.

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Guidelines Statement: All the experts involved in the formulation of this consensus attest to the fact that their recommendations are guided by a commitment to objectivity, rooted in professional knowledge, research data, and clinical experience. This consensus was primarily crafted by certain members of the Ophthalmic Imaging and Intelligent Medicine Branch of the Chinese Medicine Education Association, the Ophthalmology Committee of International Association of Translational Medicine, and Ophthalmology Committee of International Association of Intelligent Medicine.

Disclaimer: The content of this consensus is representative of the expert guidance provided to clinicians and is not meant to be prescriptive. Despite the extensive consultations and discussions undertaken by the experts, there may still be limitations in the recommendations provided. Deviations from this guide do not necessarily imply errors or irregularities in practice. Clinical practice is a constantly evolving field with ongoing research often presenting new evidence that may

necessitate alterations in diagnostic and treatment approaches. Consequently, with the growing body of clinical experience and the advent of new treatment modalities, it is expected that this consensus will undergo regular revisions and updates to continue delivering optimal clinical benefits to patients.

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REFERENCES

1 Prem Senthil M, Fenwick EK, Lamoureux E, *et al*. Identification and evaluation of items for vitreoretinal diseases quality of life item banks. *Ophthalmic Epidemiol* 2019;26(6):448-458.

2 Ribeiro L, Oliveira J, Kuroiwa D, *et al*. Advances in vitreoretinal surgery. *J Clin Med* 2022;11(21):6428.

3 Marchese A, Miserocchi E, Giuffrè C, *et al*. Aurora borealis and string of pearls in vitreoretinal lymphoma: patterns of vitreous haze. *Br J Ophthalmol* 2019;103(11):1656-1659.

4 Barbosa RC, Bastos R, Tenedório P. Recurrent macular neurosensory detachment in hypotony maculopathy managed with topical corticosteroids. *BMJ Case Rep* 2022;15(6):e248773.

5 Ye JJ, Guo LB, Wang SR, *et al*. Vitreal surgery and etiological diagnosis of bacterial endophthalmitis. *Zhonghua Yan Ke Za Zhi* 2012;48(11):995-1000.

6 Jonas JB, Ang M, Cho P, *et al*. IMI prevention of myopia and its progression. *Invest Ophthalmol Vis Sci* 2021;62(5):6.

7 Morrison AM, Mutti DO. Evaluation of a pilot protocol for detecting infant hyperopia. *Optom Vis Sci* 2023;100(5):304-311.

8 Saffarizadeh M, Rahmani S, Akbarzadeh Baghban A, *et al*. Effect of astigmatism and spherical equivalent correction on contrast sensitivity. *Int J Ophthalmol* 2024;17(12):2243-2247.

9 Bonnar J, Tan CH, McCullough P, *et al*. Scleral buckle, vitrectomy, or combined surgery for inferior break retinal detachment: systematic review and meta-analysis. *Ophthalmol Retina* 2023;7(10):837-847.

10 McCullough P, Mohite A, Virgili G, *et al*. Outcomes and complications of pars Plana vitrectomy for tractional retinal detachment in people with diabetes: a systematic review and meta-analysis. *JAMA Ophthalmol* 2023;141(2):186-195.

11 Liu BS, Cui WN, Niu R, *et al*. Refractive outcomes after vitrectomy combined with phacoemulsification of idiopathic macular holes. *Int J Ophthalmol* 2021;14(2):250-254.

12 Ye L, Zhou SS, Yang WL, *et al*. Retinal microvasculature alteration in active thyroid-associated ophthalmopathy. *Endocr Pract* 2018;24(7):658-667.

13 Huang X, Li D, Li HJ, *et al*. Abnormal regional spontaneous neural activity in visual pathway in retinal detachment patients: a resting-state functional MRI study. *Neuropsychiatr Dis Treat* 2017;13:2849-2854.

14 Liu R, Wang Y, Xia Q, *et al*. Retinal thickness and microvascular alterations in the diagnosis of systemic lupus erythematosus: a new approach. *Quant Imaging Med Surg* 2022;12(1):823-837.

15 Kumar V, Surve A, Kumawat D, *et al*. Ultra-wide field retinal imaging: a wider clinical perspective. *Indian J Ophthalmol* 2021;69(4):824-835.

16 Bravo FJV, Ayliffe W, Stanga SFE, *et al*. New imaging technology for simultaneous multiwavelength-UWF fundus fluorescein angiography and indocyanine green angiography with navigated central and peripheral SS-OCT. *Ophthalmic Surg Lasers Imaging Retina* 2023;54(7):401-410.

17 Wang Y, Shao Y, Shi WQ, *et al*. The predictive potential of altered spontaneous brain activity patterns in diabetic retinopathy and nephropathy. *EPMA J* 2019;10(3):249-259.

18 Liao XL, Yuan Q, Shi WQ, *et al*. Altered brain activity in patients with diabetic retinopathy using regional homogeneity: a resting-state fMRI study. *Endocr Pract* 2019;25(4):320-327.

19 Chandrasekaran PR, Aljneibi S, Agarwal A, *et al*. Interpreting posterior uveitis by integrating indocyanine green angiography, optical coherence tomography, and optical coherence tomography angiography data: a narrative review. *Saudi J Ophthalmol* 2022;36(4):344-355.

20 Gelişken F. Indocyanine green angiography. *Turk J Ophthalmol* 2024;54(1):38-45.

21 Bloom JN, Herman DC, Elin RJ, *et al*. Intravenous fluorescein interference with clinical laboratory tests. *Am J Ophthalmol* 1989;108(4):375-379.

22 Nasrallah FP, Jalkh AE, Trempe CL, *et al*. Low-dose fluorescein angiography. *Am J Ophthalmol* 1988;105(6):690.

23 Kornblau IS, El-Annan JF. Adverse reactions to fluorescein angiography: a comprehensive review of the literature. *Surv Ophthalmol* 2019;64(5):679-693.

24 Ma J, Yu YH, Zhong YY, *et al*. Outcomes and prognostic factors of posttraumatic endophthalmitis: a three-year retrospective study. *J Ophthalmol* 2021;2021:5526998.

25 Zhou YL, Wang YX, Yao TT, *et al*. Traumatic endophthalmitis and the outcome after vitrectomy in young children. *Int J Ophthalmol* 2020;13(3):406-411.

26 He T, You C, Chen S, *et al*. Secondary sulcus-fixed foldable IOL implantation with 25-G infusion in patients with previous PPV after open-globe injury. *Eur J Ophthalmol* 2017;27(6):786-790.

27 Hasenfratz G, Mardin C. Ultrasound diagnostics in ophthalmology (standardized echography): part 1: principles and diseases of the eyeball. *Ophthalmologe* 2014;111(10):983-995.

28 Chen W, Yang W, Li D, *et al*. Value of the strain ratio in the differential

diagnosis of intraocular tumors by elastosonography: a retrospective case-control study. *Indian J Ophthalmol* 2023;71(3):983-988.

29 Mohammadi SF, Zandian M, Fakhraie G, *et al*. Ultrasound biomicroscopy findings in fireworks-related blunt eye injuries. *Eur J Ophthalmol* 2012;22(3):342-348.

30 Pichi F, Qadha K, Almasri K, *et al*. Ultrasound biomicroscopy qualitative and quantitative signs of phacoantigenic uveitis. *Eye* (*Lond*) 2024;38(17):3368-3373.

31 Codenotti M, Iuliano L, Maestranzi G. Surgical management and techniques. *Dev Ophthalmol* 2017;60:143-159.

32 Hwang BE, Kim JY, Kim RY, *et al*. Alteration of perivascular reflectivity on optical coherence tomography of branched retinal vein obstruction. *Sci Rep* 2023;13(1):15847.

33 Murakami T, Okamoto F, Sugiura Y, *et al*. Changes in Metamorphopsia and optical coherence tomography findings after successful retinal detachment surgery. *Retina* 2018;38(4):684-691.

34 Fukuyama H, Yagiri H, Araki T, *et al*. Quantitative assessment of outer retinal folds on enface optical coherence tomography after vitrectomy for rhegmatogenous retinal detachment. *Sci Rep* 2019;9(1):2327.

35 Shi WQ, Han T, Liu R, *et al*. Retinal microvasculature and conjunctival vessel alterations in patients with systemic lupus erythematosus-an optical coherence tomography angiography study. *Front Med* (*Lausanne*) 2021;8:724283.

36 Yu L, Shao Y, Chai Y, *et al*. Retinal microvasculature alteration in central serous chorioretinopathy. *Mol Med Rep* 2018;17(2):2335-2340.

37 Obuchowska I, Konopińska J. Importance of optical coherence tomography and optical coherence tomography angiography in the imaging and differentiation of choroidal melanoma: a review. *Cancers* (*Basel*) 2022;14(14):3354.

38 Ho S, Ly A, Ohno-Matsui K, *et al*. Diagnostic accuracy of OCTA and OCT for myopic choroidal neovascularisation: a systematic review and meta-analysis. *Eye* (*Lond*) 2023;37(1):21-29.

39 Bhende M, Shetty S, Parthasarathy MK, *et al*. Optical coherence tomography: a guide to interpretation of common macular diseases. *Indian J Ophthalmol* 2018;66(1):20-35.

40 Wang Y, Liu X. Line field Fourier domain optical coherence tomography based on a spatial light modulator. *Appl Opt* 2021;60(4): 985-992.

41 Marchand PJ, Riemensberger J, Skehan JC, *et al*. Soliton microcomb based spectral domain optical coherence tomography. *Nat Commun* 2021;12(1):427.

42 Choi W, Potsaid B, Jayaraman V, *et al*. Phase-sensitive swept-source optical coherence tomography imaging of the human retina with a vertical cavity surface-emitting laser light source. *Opt Lett* 2013;38(3):338-340.

43 Yan H, Yang K, Ma Z, *et al*. Guideline for the treatment of no light perception eyes induced by mechanical ocular trauma. *J Evid Based Med* 2022;15(3):302-314.

44 Aboulhosn R, Raju B, Jumah F, *et al*. Terson's syndrome, the current concepts and management strategies: a review of literature. *Clin Neurol Neurosurg* 2021;210:107008.

45 Vaishnav YJ, Portelli D, Migliori ME. Delayed diagnosis of an occult wooden orbital foreign body. *R I Med J* (*2013*) 2020;103(5):49-51.

46 Murray-Douglass A, Snoswell C, Winter C, *et al*. Three-dimensional (3D) printing for post-traumatic orbital reconstruction, a systematic review and meta-analysis. *Br J Oral Maxillofac Surg* 2022;60(9): 1176-1183.

47 Xiang CQ, Liu WF, Xu QH, *et al*. Altered spontaneous brain activity in patients with classical trigeminal neuralgia using regional homogeneity: a resting-state functional MRI study. *Pain Pract* 2019;19(4):397-406.

48 Chen Y, Xiang CQ, Liu WF, *et al*. Application of amplitude of low-frequency fluctuation to altered spontaneous neuronal activity in classical trigeminal neuralgia patients: a resting-state functional MRI study. *Mol Med Rep* 2019;20(2):1707-1715.

49 Xu MW, Liu HM, Tan G, *et al*. Altered regional homogeneity in patients with corneal ulcer: a resting-state functional MRI study. *Front Neurosci* 2019;13:743.

50 Wang Y, Jiang L, Wang XY, *et al*. Evidence of altered brain network centrality in patients with diabetic nephropathy and retinopathy: an fMRI study using a voxel-wise degree centrality approach. *Ther Adv Endocrinol Metab* 2019;10:2042018819865723.

51 Cohen LM, Yoon MK. Update on current aspects of orbital imaging: CT, MRI, and ultrasonography. *Int Ophthalmol Clin* 2019;59(4):69-79.

52 Branstetter BF 4th, Hampton ED. Rate of metallic foreign bodies found on orbital radiographs prior to MRI. *Curr Probl Diagn Radiol* 2024;53(3):369-371.

53 Bruera MG, Benedetto MM, Guido ME, *et al*. Glial cell response to constant low light exposure in rat retina. *Vis Neurosci* 2022;39:E005.

54 Igawa Y, Amaki H, Kanno J, *et al*. Evaluations of microvascular density by optical coherence tomography, angiography, and function by multifocal electroretinography of the macular area in eyes with branch retinal artery occlusion. *Front Ophthalmol* (*Lausanne*) 2023;3:1255098.

55 Robson AG, Frishman LJ, Grigg J, *et al*. ISCEV Standard for full-field clinical electroretinography (2022 update). *Doc Ophthalmol* 2022;144(3):165-177.

56 Papachristou A, Lambraki A, Giannakopoulou T, *et al*. Silicone oil insulation effects on flash electroretinogram and visual evoked potential in patients with retinal detachment. *J Optom* 2024;17(2):100502.

57 Hoffmann MB, Bach M, Kondo M, *et al*. ISCEV standard for clinical multifocal electroretinography (mfERG) (2021 update). *Doc Ophthalmol* 2021;142(1):5-16.

58 Vikas SJ, Agarwal D, Seth S, *et al*. Comparison of anatomical and functional outcomes of vitrectomy with internal limiting membrane peeling in recalcitrant diabetic macular edema with and without traction in Indian patients. *Indian J Ophthalmol* 2021;69(11):3297-3301.

59 Zheng X, Xu G, Zhang K, *et al*. Assessment of human visual acuity using visual evoked potential: a review. *Sensors* (*Basel*) 2020;20(19):5542.

60 Hofmann MH, Gebhardt IC. Evolution of the visual system in ray-finned fishes. *Vis Neurosci* 2023;40:E005.

61 Ahmed M, Lee CS, McMillan B, *et al*. Predicting visual function after an ocular bee sting. *Int Ophthalmol* 2019;39(7):1621-1626.

62 Odom JV, Bach M, Brigell M, *et al*. ISCEV standard for clinical visual evoked potentials: (2016 update). *Doc Ophthalmol* 2016; 133(1):1-9.

63 Swaminathan U, Daigavane S. Unveiling the potential: a comprehensive review of artificial intelligence applications in ophthalmology and future prospects. *Cureus* 2024;16(6):e61826.

64 Abràmoff MD, Lavin PT, Birch M, *et al*. Pivotal trial of an autonomous AI-based diagnostic system for detection of diabetic retinopathy in primary care offices. *NPJ Digit Med* 2018;1:39.

65 Ting DSW, Cheung CY, Lim G, *et al*. Development and validation of a deep learning system for diabetic retinopathy and related eye diseases using retinal images from multiethnic populations with diabetes. *JAMA* 2017;318(22):2211-2223.

66 Shao Y, Ma J, Wang CY, *et al*. Expert consensus for preoperative visual function and imaging examination standards in vitreoretinal surgery (2024). *Guoji Yanke Zazhi (Int Eye Sci)* 2024;24(12):1851-1862.