SUMMARY BENCHMARKS FOR PREFERRED PRACTICE PATTERN® GUIDELINES

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SUMMARY BENCHMARKS FOR PREFERRED PRACTICE PATTERN® GUIDELINES

Introduction

These are summary benchmarks for the Academy's Preferred Practice Pattern® (PPP) guidelines. The Preferred Practice Pattern series of guidelines has been written on the basis of three principles.

- Each Preferred Practice Pattern should be clinically relevant and specific enough to provide useful information to practitioners.
- Each recommendation that is made should be given an explicit rating that shows its importance to the care process.
- Each recommendation should also be given an explicit rating that shows the strength of evidence that supports the recommendation and reflects the best evidence available.

Preferred Practice Patterns provide guidance for the pattern of practice, not for the care of a particular individual. While they should generally meet the needs of most patients, they cannot possibly best meet the needs of all patients. Adherence to these Preferred Practice Patterns will not ensure a successful outcome in every situation. These practice patterns should not be deemed inclusive of all proper methods of care or exclusive of other methods of care reasonably directed at obtaining the best results. It may be necessary to approach different patients' needs in different ways. The physician must make the ultimate judgment about the propriety of the care of a particular patient in light of all of the circumstances presented by that patient. The American Academy of Ophthalmology is available to assist members in resolving ethical dilemmas that arise in the course of ophthalmic practice.

The Preferred Practice Pattern® guidelines are not medical standards to be adhered to in all individual situations. The Academy specifically disclaims any and all liability for injury or other damages of any kind, from negligence or otherwise, for any and all claims that may arise out of the use of any recommendations or other information contained herein.

For each major disease condition, recommendations for the process of care, including the history, physical exam and ancillary tests, are summarized, along with major recommendations for the care management, follow-up, and education of the patient. For each PPP, a detailed literature search of PubMed and the Cochrane Library for articles in the English language is conducted. The results are reviewed by an expert panel and used to prepare the recommendations, which are then given a rating that shows the strength of evidence when sufficient evidence exists.

To rate individual studies, a scale based on the Scottish Intercollegiate Guideline Network (SIGN) is used. The definitions and levels of evidence to rate individual studies are as follows:

- I++: High-quality meta-analyses, systematic reviews of randomized controlled trials (RCTs), or RCTs with a very low risk of bias
- I+: Well-conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias
- I–: Meta-analyses, systematic reviews of RCTs, or RCTs with a high risk of bias
- II++: High-quality systematic reviews of case-control or cohort studies; high-quality case-control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal
- II+: Well-conducted case-control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal
- II–: Case-control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal
- III: Nonanalytic studies (e.g., case reports, case series)

Recommendations for care are formed based on the body of the evidence. The body of evidence quality ratings are defined by Grading of Recommendations Assessment, Development and Evaluation (GRADE) as follows:

- Good quality (GQ): Further research is very unlikely to change our confidence in the estimate of effect
- Moderate quality (MQ): Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate
- Insufficient quality (IQ): Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate; any estimate of effect is very uncertain

SUMMARY BENCHMARKS FOR PREFERRED PRACTICE PATTERN® GUIDELINES

Introduction *(continued)*

Key recommendations for care are defined by GRADE as follows:

- Strong recommendation (SR): Used when the desirable effects of an intervention clearly outweigh the undesirable effects or clearly do not
- Discretionary recommendation (DR): Used when the trade-offs are less certain—either because of low-quality evidence or because evidence suggests that desirable and undesirable effects are closely balanced

In PPPs prior to 2011, the panel rated recommendations according to its importance to the care process. This "importance to the care process" rating represents care that the panel thought would improve the quality of the patient's care in a meaningful way. The ratings of importance are divided into three levels.

- Level A, defined as most important
- Level B, defined as moderately important
- Level C, defined as relevant but not critical

The panel also rated each recommendation on the strength of evidence in the available literature to support the recommendation made. The "ratings of strength of evidence" also are divided into three levels.

- Level I includes evidence obtained from at least one properly conducted, well-designed randomized controlled trial. It could include meta-analyses of randomized controlled trials.
- Level II includes evidence obtained from the following:
  - Well-designed controlled trials without randomization
  - Well-designed cohort or case-control analytic studies, preferably from more than one center
  - Multiple-time series with or without the intervention
- Level III includes evidence obtained from one of the following:
  - Descriptive studies
  - Case reports
  - Reports of expert committees/organizations (e.g., PPP panel consensus with external peer review)

This former approach, however, will eventually be phased out as the AAO adopted the SIGN and GRADE rating and grading systems.

The PPPs are intended to serve as guides in patient care, with greatest emphasis on technical aspects. In applying this knowledge, it is essential to recognize that true medical excellence is achieved only when skills are applied in a such a manner that the patients' needs are the foremost consideration. The AAO is available to assist members in resolving ethical dilemmas that arise in the course of practice. (AAO Code of Ethics)

Primary Open-Angle Glaucoma (Initial Evaluation)

Initial Exam History (Key elements)

- Ocular history (e.g., refractive error, trauma, prior ocular surgery)
- Race/ethnicity
- Family history
- Systemic history
- Review of pertinent records
- Current medications
- Prior glaucoma laser or incisional surgery

Initial Physical Exam (Key elements)

- Visual acuity measurement
- Pupil examination
- Confrontational visual fields
- Slit-lamp biomicroscopy
- IOP measurement
- Gonioscopy
- Optic nerve head (ONH) and retinal nerve fiber layer (RNFL) examination
- Fundus examination

Diagnostic Testing (Key elements)

- Central corneal thickness (CCT) measurement
- Visual field evaluation
- ONH, RNFL, and macular imaging

Management Plan for Patients in Whom Therapy is Indicated

- The goal of treatment is to control the IOP in a target range and ensure the ONH/RNFL and visual fields are stable
- Target IOP is an estimate and must be individualized and/or adjusted during the course of the disease
- Set an initial target pressure of at least 25% lower than pretreatment IOP. Choosing a lower target IOP can be justified if there is more severe optic nerve damage, if the damage is progressing rapidly, or if other risk factors are present (e.g., family history, age, or disc hemorrhages)
- The IOP can be lowered by medical treatment, laser therapy, or incisional surgery (alone or in combination)
- Medical therapy is presently the most common initial intervention to lower IOP (see Table 4 of the POAG PPP for an overview of options available); consider balance between side effects and effectiveness in choosing a regimen of maximal effectiveness and tolerance to achieve the desired IOP reduction for each patient
- If progression occurs at the target pressure, undetected IOP fluctuations and adherence to the therapeutic regimen and recommendations for therapeutic alternatives should be discussed before adjusting target IOP downward
- Assess the patient who is being treated with glaucoma medication for local ocular and systemic side effects and toxicity
- Laser trabeculoplasty may be used as initial or adjunctive therapy in patients with POAG (see Table 5 of the POAG PPP). Laser trabeculoplasty is effective in lowering IOP and may be performed to 180 degrees or to 360 degrees of the angle.

Perioperative Care for Laser Trabeculoplasty Patients

- The ophthalmologist who performs surgery has the following responsibilities:
  - Obtain informed consent from the patient or patient's surrogate decision maker after discussing the risk, benefits, and expected outcomes of surgery
  - Ensure that the preoperative evaluation confirms that surgery is indicated
  - At least one IOP check immediately prior to surgery and within 30 minutes to 2 hours after surgery
  - Follow-up examination within 6 weeks of surgery or sooner if there is concern about IOP-related damage to the optic nerve

Perioperative Care in Incisional Glaucoma Surgery Patients

- The ophthalmologist who performs surgery has the following responsibilities:
  - Perform gonioscopy preoperatively, especially when considering trabecular meshwork/Schlemm's canal-based MIGS (see Table 6 of the POAG PPP)
  - Obtain informed consent from the patient or patient's surrogate decision maker after discussing the risk, benefits, and expected outcomes of surgery
  - Ensure that the preoperative evaluation accurately documents findings and indications for surgery
  - Prescribe topical corticosteroids in the postoperative period
  - Follow-up evaluation on the first postoperative day and at least once during the first 1 to 2 weeks to evaluate visual acuity, IOP, and status of the anterior segment
  - In the absence of complications, perform additional postoperative visits during a 3-month period to evaluate visual acuity, IOP, and status of the anterior segment
  - Schedule more frequent follow-up visits, as necessary, for patients with postoperative complications (flat or shallow anterior chamber, early bleb failure, increased inflammation, or Tenon's cyst)

Primary Open-Angle Glaucoma (Initial Evaluation) *(continued)*

- Undertake additional treatments as necessary to improve aqueous flow into the bleb and lower IOP if evidence of bleb failure develops, including injection of antifibrotic agents, bleb massage, suture adjustment, release or lysis, or bleb needling
- Manage postoperative complications as they develop, such as repair of bleb leak or reformation of a flat anterior chamber
- Explain that filtration surgery places the eye at risk for endophthalmitis for the duration of the patient's life, and that if the patient has symptoms of pain and decreased vision and the signs of redness and discharge he or she should notify the ophthalmologist immediately

Patient Education for Patients with Medical Therapy

- Discuss diagnosis, severity of the disease, prognosis and management plan, and likelihood of lifelong therapy
- Educate about eyelid closure or nasolacrimal occlusion when applying topical medications to reduce systemic absorption
- Encourage patients to alert their ophthalmologist to physical or emotional changes that occur when taking glaucoma medications

Primary Open-Angle Glaucoma (Follow-up Evaluation)

Follow-up Exam History

- Interval ocular history
- Interval systemic medical history
- Side effects of ocular medications
- Review of pertinent medication use, including time of last administration

Follow-up Physical Exam

- Visual acuity measurement
- Slit-lamp biomicroscopy
- IOP measurement
- Perform gonioscopy if there is a suspicion of angle-closure component, anterior chamber shallowing or anterior chamber angle abnormalities, or if there is an unexplained change in IOP. Perform gonioscopy periodically
- ONH and visual field evaluation

Adjustment of Therapy

- Target IOP is not achieved and benefits of a change in therapy outweigh the risks
- Progressive optic nerve damage despite achieving the target IOP
- Patient's intolerant of the prescribed medical regimen
- Contraindications to individual medications develop
- Stable optic nerve status and low IOP occur for a prolonged period in a patient taking topical ocular hyopotensive agents. Under these circumstances, a carefully monitored attempt to reduce the medical regimen may be appropriate
- Downward adjustment of target pressure can be made in the face of progressive optic disc, imaging, or visual field change
- Upward adjustment of target pressure can be considered if the patient has been stable and if the patient either requires or desires less medication

Patient Education

- Educate about the disease process, the rationale and goals of intervention, the status of their condition, and relative benefits and risks of alternative interventions so that patients can participate meaningfully in developing an appropriate plan of action
- Patients considering keratorefractive surgery should be informed about the possible impact laser vision correction has on reducing contrast sensitivity and decreasing the accuracy of IOP measurements
- Patients with substantial visual impairment or blindness can be referred for and encouraged to use appropriate vision rehabilitation and social services

Follow-Up:

Consensus-based Guidelines for Follow-up Glaucoma Status

Target IOP Achieved	Progression of Damage	Duration of Control (months)	Approximate Follow-up Interval (months)*
Yes	No	≤6	6
Yes	No	>6	12
Yes	Yes	NA	1–2
No	Yes	NA	1–2
No	No	NA	3–6

IOP = intraocular pressure; NA = not applicable

*Patients with more advanced damage or greater lifetime risk from primary open-angle glaucoma may require more frequent evaluations. These intervals are the maximum recommended time between evaluations.

Primary Open-Angle Glaucoma Suspect (Initial and Follow-up Evaluation)

Initial Exam History (Key elements)

- Ocular history (e.g., refractive error, trauma, prior ocular surgery)
- Race/ethnicity
- Family history
- Systemic history
- Review of pertinent records
- Current and prior ocular and nonocular medications
- Prior cataract surgery, LASIK and/or incisional surgery

Initial Physical Exam (Key elements)

- Visual acuity measurement
- Pupil examination
- Confrontation visual field
- Slit-lamp biomicroscopy
- IOP measurement
- Gonioscopy
- Optic nerve head (ONH) and retinal nerve fiber layer (RNFL) examination
- Fundus examination

Diagnostic Testing (Key elements)

- Central corneal thickness (CCT) measurement
- Visual field evaluation. If visual field glaucomatous damage is newly detected in a glaucoma suspect patient, it is best to repeat testing
- ONH, RNFL, and macular imaging. Clinicians should include all perimetric and other structural information in addition to digital imaging technology when formulating patient management decisions

Management Plan for Patients in Whom Therapy is Indicated

- The goal of treatment is to monitor or lower IOP through treatment if an eye is likely to progress to POAG; monitor for structural changes in optic disc and retina; and monitor for functional changes of the optic nerve assessing the visual field
- The decision to treat a glaucoma suspect patient may arise in various settings (see POAG Suspect PPP for detailed considerations)
- Target IOP is an estimate and must be individualized and/or adjusted during the course of the disease
- Medical therapy is presently the most common initial intervention to lower IOP (see Table 2 of the POAG Suspect PPP for an overview of options available); consider balance between side effects and effectiveness in choosing a regimen of maximal effectiveness and tolerance to achieve the desired IOP reduction for each patient
- If a medical therapy fails to reduce IOP sufficiently, then either switching to an alternative medication as monotherapy or adding additional medication is appropriate until the desired IOP level is attained

Follow-up Exam History

- Interval ocular history
- Interval systemic medical and medication history
- Side effects of ocular medications if the patient is being treated
- Review of pertinent medication use if the patient is being treated, including the time of the last administration

Follow-up Physical Exam

- Visual acuity measurement
- Slit-lamp biomicroscopy
- IOP measurement
- Gonioscopy is indicated when there is a suspicion of development of an angle-closure component, anterior chamber shallowing, anterior chamber angle abnormalities, or unexplained change in IOP

Adjustment of Therapy

- Target IOP is not achieved and the benefits of a change in therapy outweigh the risks for the patient
- The patient is intolerant of the prescribed medical regimen
- The patient does not adhere to the prescribed medical regimen due to costs or other factors
- New systemic conditions or treatments develop that could be a contraindication to the current glaucoma therapy
- The patient under treatment has been stable for a prolonged period without progression to POAG, in which case cautious withdrawal of therapy may be considered
- The patient has converted to POAG (see Primary Open-Angle Glaucoma PPP)

Primary Open-Angle Glaucoma Suspect (Initial and Follow-up Evaluation) *(continued)*

Patient Education

- Discuss number and severity of risk factors, prognosis, life expectancy, management plan, and likelihood that therapy, once started, can be continued long term
- Educate about their condition and its potential to lead to glaucoma, the status of their condition, the rationale and goals of intervention, and relative benefits and risks of alternative interventions
- Educate about eyelid closure or nasolacrimal occlusion to reduce systemic absorption after medication instillation
- Encourage patients to alert their ophthalmologist to physical or emotional changes that occur when taking glaucoma medications
- Patients with substantial visual impairment or blindness can be referred for and encouraged to use appropriate vision rehabilitation and social services

Primary Angle-Closure Disease (Initial Evaluation and Therapy)

Initial Exam History (Key elements)

- Ocular history (e.g., blurred vision, halos around lights, eye pain, headache, eye redness)
- Family history of acute angle-closure crisis (AACC)
- Systemic history (e.g., use of topical or systemic medications)

Initial Physical Exam (Key elements)

- Refractive status
- Pupil examination
- Slit-lamp biomicroscopy
  - Conjunctival hyperemia (in acute cases)
  - Central and peripheral anterior chamber depth narrowing
  - Anterior chamber inflammation suggestive of a recent or current attack
  - Corneal swelling. (Microcystic edema and stromal edema are common in acute cases.)
  - Small corneal diameter (indicative of a smaller eye at greater risk for PACD)
  - Iris abnormalities, including diffuse or focal atrophy, posterior synechiae, abnormal pupillary function, irregular pupil shape, and a mid-dilated pupil (suggestive of a recent or current attack)
  - Lens changes, including cataract and glaukomflecken
  - Corneal endothelial cell loss
- IOP measurement
- Gonioscopy
- Evaluation of fundus and optic nerve head using direct ophthalmoscope or slit-lamp biomicroscope with an indirect lens, the central portion of the gonioscopy lens, or by imaging the retina and optic nerve with photography using a nonmydriatic camera through an undilated pupil

Diagnostic Testing (Key elements)

- Anterior segment imaging
- Ocular biometry
- Provocative testing

Management Plan for Patients in Whom Iridotomy is Indicated

- In patients with Primary Angle-Closure Suspect (PACS), iridotomy may be considered to reduce the risk of developing angle closure
- In acute angle-closure crisis (AACC), use medical therapy first to lower the IOP to reduce pain and to clear corneal edema (see Table 4 of the POAG PPP). Iridotomy should then be performed as soon as possible
- Laser iridotomy is the preferred surgical treatment for AACC because it has a favorable risk-benefit ratio; but patients with PACS who have not had an iridotomy should be warned of potential risk for AACC and certain medicines could cause pupil dilation and induce AACC
- Selection of cyclophotocoagulation over other procedures should be left to the discretion of the treating ophthalmologist, in consultation with the individual patient
- The fellow eye should be scheduled for a prophylactic iridotomy if the chamber angle is anatomically narrow, since approximately half of fellow eyes can develop AACC within 5 years
- Given the lack of convincing evidence for prophylactic use of iridoplasty in patients with plateau iris, and since iridoplasty can be painful and may cause inflammation, the decision of whether to observe or treat these eyes is left to the judgment of the testing ophthalmologist

Perioperative Care for Iridotomy Patients

- The ophthalmologist who performs surgery has the following responsibilities:
  - Obtain informed consent from the patient or patient's surrogate decision maker after discussing the risk, benefits, and expected outcomes of surgery
  - Ensure that preoperative evaluation confirms the need for surgery
  - Consider the preoperative use of a parasympathomimetic to facilitate LPI
  - Use topical ocular hypotensive agents perioperatively to prevent sudden IOP elevation, particularly for patients who have severe disease
  - Ensure the patency of the iridotomy by directly visualizing fluid flow of aqueous and pigment from the posterior to anterior chamber. Visualization of a red reflex alone is insufficient to confirm patency
  - Enlarge the iridotomy as necessary to achieve diameter of at least 100 microns
  - Perform at least one IOP check immediately prior to surgery and within 30 minutes to 2 hours following surgery
  - Prescribe topical corticosteroids in the postoperative period
  - Ensure that the patient receives adequate postoperative care

Primary Angle-Closure Disease (Initial Evaluation and Therapy) *(continued)*

- Follow-up evaluations include:
  - Confirm patency of iridotomy by visualizing zonules, the anterior lens capsule, or ciliary processes
  - IOP measurement
  - Perform dark-room gonioscopy with compression/indentation to assess the extent of peripheral anterior synechiae (PAS) if it was not performed immediately following iridotomy
  - Examine the fundus as clinically indicated

Follow-up of Patients after Iridotomy

- Patients (with or without glaucomatous optic neuropathy) with a residual open angle or a combination of open angle and some PAS should be followed at appropriate intervals to check for increasing PAS
- If IOP remains elevated long term and patient develops PAC or PACG, then ongoing medical therapy to lower IOP may become necessary (see follow-up procedures and intervals in POAG PPP)

Patient Education

- Patients with PAS who have not had an iridotomy should be warned of potential risk for AACC and that certain medicines could cause pupil dilation and induce AACC
- Patients should be informed about the symptoms of AACC and instructed to notify their ophthalmologist immediately if symptoms occur
- Patients with substantial visual impairment or blindness can be referred for and encouraged to use appropriate vision rehabilitation and social services

Age-Related Macular Degeneration (Initial and Follow-up Evaluation)

Initial Exam History (Key elements)

- Symptoms (metamorphopsia, decreased vision, scotoma, photopsia, difficulties in dark adaptation)
- Medications and nutritional supplement use
- Ocular history
- Medical history (any hypersensitivity reactions)
- Family history, especially family history of AMD
- Social history, especially smoking

Initial Physical Exam (Key elements)

- Comprehensive eye examination
- Amsler Grid
- Stereo biomicroscopic examination of the macula

Diagnostic Tests

Optical coherence tomography is important in diagnosing and managing AMD, particularly with respect to determining the presence of subretinal and intraretinal fluid and in documenting the degree of retinal thickening. Optical coherence tomography defines the cross sectional architecture of the retina, which is not possible with any other imaging technology. It may reveal the presence of fluid that is not apparent on biomicroscopy alone. It also assists in evaluating the response of the retina and RPE to therapy by allowing structural changes to be followed accurately. Newer generation OCT modalities, including SD-OCT, are preferred technologies.

Optical coherence tomography angiography (OCTA) is a newer imaging modality that provides noninvasive evaluation of the retinal and choroidal vasculature and is being more commonly applied in the evaluation and management of AMD, but it has not replaced other angiographic methods.

Intravenous fundus fluorescein angiography is indicated:

- when patient complains of new metamorphopsia
- when patient has unexplained blurred vision
- when clinical exam reveals elevation of the RPE or retina, macular edema, subretinal blood, hard exudates or subretinal fibrosis or the OCT shows evidence of fluid.
- to detect the presence of and determine the extent, type, size, and location of CNV
- to guide treatment (laser photocoagulation surgery or verteporfin PDT)
- to detect persistent or recurrent CNV or other retinal diseases following treatment
- to assist in determining the cause of visual loss that is not explained by clinical exam

Each angiographic facility should have a care plan for an emergency and a clear protocol to minimize the risks and to manage complications.

Follow-up Exam History

- Visual symptoms, including decreased vision and metamorphopsia
- Changes in medications and nutritional supplements
- Changes in ocular history and medical history
- Changes in social history, especially smoking

Follow-up Physical Exam

- Visual acuity at distance with correction
- Amsler Grid
- Stereo biomicroscopic examination of the fundus

Follow-up after Treatment for Neovascular AMD

- Examine patients treated with intravitreal injections of aflibercept, bevacizumab, or ranibizumab approximately at 4-week intervals
- Subsequent examinations, OCT, and fluorescein angiography should be performed as indicated depending on the clinical findings and the judgment of the treating ophthalmologist

Patient Education

- Educate patients about the prognosis and potential value of treatment as appropriate for their visual and functional status
- Encourage patients with early AMD or a family history of AMD to assess their own visual acuity using monocular vision testing and to have regular dilated eye exams for early detection of intermediate AMD
- Educate patients with a high-risk AMD phenotype about methods of detecting new symptoms of CNV and about the need for prompt notification to an ophthalmologist
- Instruct patients with unilateral disease to monitor their vision in their fellow eye and to return periodically even in absence of symptoms, but promptly after onset of new or significant visual symptoms
- Instruct patients to report symptoms suggestive of endophthalmitis, including eye pain or increased discomfort, worsening eye redness, blurred or decreased vision, increased sensitivity to light, or increased number of floaters promptly
- Encourage patients who are currently smoking to stop because there are observational data that support a causal relationship between smoking and AMD and other considerable health benefits of smoking cessation
- Refer patients with reduced visual function for vision rehabilitation (see www.aao.org/low-vision-and-vision-rehab) and social services

Age-Related Macular Degeneration (Management Recommendations)

Treatment Recommendations and Follow-up Plans for Age-Related Macular Degeneration

Recommended Treatment	Diagnoses Eligible for Treatment	Follow-up Recommendations
Non-neovascular AMD Observation with no medical or surgical therapies	Early AMD (AREDS category 2)	Return exam at 6 to 24 months if asymptomatic or prompt exam for new symptoms suggestive of CNV
	Advanced AMD with bilateral subfoveal geographic atrophy or disciform scars	Return exam at 6 to 24 months if asymptomatic or prompt exam for new symptoms suggestive of CNV Fundus photos, fluorescein angiography, OCT, or OCTA as appropriate
Non-neovascular AMD Antioxidant vitamin and mineral supplements as recommended in the original AREDS and AREDS2 reports	Intermediate AMD (AREDS category 3) Advanced AMD in one eye (AREDS category 4)	Return exam at 6 to 18 months if asymptomatic or prompt exam for new symptoms suggestive of CNV Monitoring of monocular near vision (reading/Amsler grid) Fundus photography and/or fundus autofluorescence as appropriate Fluorescein angiography and/or OCT for suspicion of CNV
Neovascular AMD Aflibercept intravitreal injection 2.0 mg as described in published reports	Macular CNV	Patients should be instructed to report promptly symptoms suggestive of endophthalmitis, including eye pain or increased discomfort, worsening eye redness, blurred or decreased vision, increased sensitivity to light, or increased number of floaters Return examination approximately 4 weeks after treatment initially; subsequent follow-up and treatment depends on the clinical findings and judgment of the treating ophthalmologist. An every 8-week maintenance treatment regimen has been shown to have comparable results to every 4 weeks in the first year of therapy. Monitoring of monocular near vision (reading/Amsler grid)
Neovascular AMD Bevacizumab intravitreal injection 1.25 mg as described in published reports The ophthalmologist should provide appropriate informed consent with respect to the off-label status	Macular CNV	Patients should be instructed to report any symptoms suggestive of endophthalmitis promptly, including eye pain or increased discomfort, worsening eye redness, blurred or decreased vision, increased sensitivity to light, or increased number of floaters Return exam approximately 4 weeks after treatment; subsequent follow-up depends on the clinical findings and judgment of the treating ophthalmologist Monitoring of monocular near vision (reading/Amsler grid)
Neovascular AMD Brolucizumab intravitreal injection 6.0 mg as described in FDA labeling	Macular CNV	Patients should be instructed to report any symptoms suggestive of endophthalmitis promptly, including eye pain or increased discomfort, worsening eye redness, blurred or decreased vision, increased sensitivity to light, or increased number of floaters Return exam approximately 4 weeks after treatment; subsequent follow-up depends on the clinical findings and judgment of the treating ophthalmologist Monitoring of monocular near vision (reading/Amsler grid)
Neovascular AMD Ranibizumab intravitreal injection 0.5 mg as recommended in literature	Macular CNV	Patients should be instructed to report any symptoms suggestive of endophthalmitis promptly, including eye pain or increased discomfort, worsening eye redness, blurred or decreased vision, increased sensitivity to light, or increased number of floaters Return exam approximately 4 weeks after treatment; subsequent follow-up depends on the clinical findings and judgment of the treating ophthalmologist Monitoring of monocular near vision (reading/Amsler grid)
Less Commonly Used Treatments for Neovascular AMD PDT with verteporfin as recommended in the TAP and VIP reports*	Macular CNV, new or recurrent, where the classic component is >50% of the lesion and the entire lesion is ≤5400 microns in greatest linear diameter Occult CNV may be considered for PDT with vision <20/50 or if the CNV is <4 MPS disc areas in size when the vision is >20/50 Juxtafoveal CNV is an off-label indication for PDT, but may be considered in select cases.	Return exam approximately every 3 months until stable, with retreatments as indicated Monitoring of monocular near vision (reading/Amsler grid)
Less Commonly Used Treatments for Neovascular AMD Thermal laser photocoagulation surgery as recommended in the MPS reports is rarely used	May be considered for extrafoveal classic CNV, new or recurrent May be considered for juxtapapillary CNV	Return exam with fluorescein angiography approximately 2 to 4 weeks after treatment, and then at 4 to 6 weeks and thereafter depending on the clinical and angiographic findings Retreatments as indicated Monitoring of monocular near vision (reading/Amsler grid)

AMD = age-related macular degeneration; AREDS = Age-Related Eye Disease Study; CNV = choroidal neovascularization; MPS = Macular Photocoagulation Study; OCT = optical coherence tomography; OCTA = optical coherence tomography angiography; PDT = photodynamic therapy; TAP = Treatment of Age-Related Macular Degeneration with Photodynamic Therapy; VIP = Verteporfin in Photodynamic Therapy

*Contraindicated in patients with porphyria or known allergy

Diabetic Retinopathy (Initial and Follow-up Evaluation)

Initial Exam History (Key elements)

- Duration of diabetes
- Past glycemic control (hemoglobin A1c)
- Medications
- Medical history (e.g., obesity, renal disease, systemic hypertension, serum lipid levels, pregnancy)
- Ocular history

Initial Physical Exam (Key elements)

- Visual acuity
- Slit-lamp biomicroscopy
- Measurement of IOP
- Gonioscopy before dilation when indicated (for neovascularization of the iris or increased IOP)
- Pupillary assessment for optic nerve dysfunction
- Thorough funduscopy including stereoscopic examination of the posterior pole
- Examination of the peripheral retina and vitreous, best performed with indirect ophthalmoscopy or with slit-lamp biomicroscopy

Diagnosis

- Classify both eyes as to category and severity of diabetic retinopathy and macular edema. *(III, GQ, SR)* Each category has an inherent risk for progression and is dependent on adherence to overall diabetes control.

Follow-up History

- Visual symptoms
- Systemic status (pregnancy, blood pressure, serum lipids, renal status)
- Glycemic status (hemoglobin A1c)
- Other treatments (dialysis, fenofibrates)

Follow-up Physical Exam

- Visual acuity
- Slit-lamp biomicroscopy with iris examination
- Measurement of IOP
- Gonioscopy (preferably before dilation when iris neovascularization is suspected or if IOP is elevated)
- Stereoscopic examination of the posterior pole after dilation of the pupils
- Examination of the peripheral retina and vitreous when indicated
- OCT imaging when appropriate

Ancillary Tests

- Color Fundus photography may be useful for documenting the severity of the diabetes presence of NVE and NVD, the response to treatment, and the need for additional treatment at future visits.
- Optical coherence tomography can be used to quantify retinal thickness, monitor macular edema, identify vitreomacular traction, and detect other forms of macular disease in patients with diabetic macular edema. Decisions to treat with anti-VEGF injections, change therapeutic agents (e.g., use of intraocular corticosteroids), initiate laser treatment, or even consider vitrectomy surgery are often based in part on OCT findings.
- Fluorescein angiography is not routinely indicated as a part of the examination of patients with diabetes. Fluorescein angiography is used as a guide for laser treatment of CSME and as a means of evaluating the cause(s) of unexplained decreased visual acuity. Angiography can identify macular capillary nonperfusion as possible explanations for visual loss that is unresponsive to therapy.
- Optical coherence tomography angiography offers a noninvasive nature and the ability to visualize depth-resolved, capillary-level abnormalities in the three retinal plexuses, offering a much more quantitative assessment of macular ischemia. Although the technology is FDA approved, the guidelines and indications for use in diabetic retinopathy are evolving.
- Ultrasonography enables assessment of the status of the retina in the presence of a vitreous hemorrhage or other media opacity, and may be helpful to define the amount of vitreous hemorrhage, the extent and severity of vitreoretinal traction, and diagnose diabetic retinal detachments in the setting of media opacity.

Patient Education

- Discuss results of exam and implications
- Encourage patients with diabetes but without diabetic retinopathy to have annual dilated eye exams
- Inform patients that effective treatment for diabetic retinopathy depends on timely intervention, despite good vision and no ocular symptoms, and that current treatments often require multiple visits and evaluations over time for adequate delivery of therapeutic effect
- Educate patients about the importance of maintaining near-normal glucose levels and near-normal blood pressure and lowering serum lipid levels
- Communicate with the attending physician, e.g., family physician, internist, or endocrinologist, regarding eye examination findings
- Provide patients whose conditions fail to respond to surgery and for whom further treatment is unavailable with professional support and offer referral for counseling, rehabilitative, or social services as appropriate
- Refer patients with functionally limiting postoperative visual impairment for vision rehabilitation (see www.aao.org/low-vision-and-vision-rehab) and social services

Diabetic Retinopathy (Management Recommendations)

Management Recommendations for Patients with Diabetes

Severity of Retinopathy	Presence of Macular Edema	Follow-up (Months)	Panretinal Photocoagulation (Scatter) Laser	Focal and/or Grid Laser*	Intravitreal Anti-VEGF Therapy
Normal or minimal NPDR	No	12	No	No	No
Mild NPDR	No	12	No	No	No
	NCI-DME	3-6	No	Sometimes	No
	CI-DME†	1*	No	Rarely	Usually
Moderate NPDR	No	6-12‡	No	No	No
	NCI-DME	3–6	No	Sometimes	Rarely
	CI-DME†	1*	No	Rarely	Usually
Severe NPDR	No	3-4	Sometimes	No	Sometimes
	NCI-DME	2–4	Sometimes	Sometimes	Sometimes
	CI-DME†	1*	Sometimes	Rarely	Usually
Non-high-risk PDR	No	3-4	Sometimes	No	Sometimes
	NCI-DME	2–4	Sometimes	Sometimes	Sometimes
	CI-DME†	1*	Sometimes	Sometimes	Usually
High-risk PDR	No	2-4	Recommended	No	Sometimes[1,2]
	NCI-DME	2-4	Recommended	Sometimes	Sometimes
	CI-DME†	1*	Recommended	Sometimes	Usually

Anti-VEGF = anti-vascular endothelial growth factor; CI-DME = center-involved diabetic macular edema; NCI-DME = noncenter-involved diabetic macular edema: NPDR = nonproliferative diabetic retinopathy; PDR = proliferative diabetic retinopathy

* Adjunctive treatments that may be considered include intravitreal corticosteroids or anti-VEGF agents (off-label use, except aflibercept and ranibizumab). Data from the Diabetic Retinopathy Clinical Research Network in 2011 demonstrated that, at two years of follow-up, intravitreal ranibizumab with prompt or deferred laser resulted in greater visual acuity gain and intravitreal triamcinolone acetonide plus laser also resulted in greater visual gain in pseudophakic eyes compared with laser alone. Individuals receiving the intravitreal injections of anti-VEGF agents may be re-examined as early as one month following injection.

† Exceptions include hypertension or fluid retention associated with heart failure, renal failure, pregnancy, or any other causes that may aggravate macular edema. For patients with good visual acuity (20/25 or better) and CI-DME, there is no difference between observation plus aflibercept if visual acuity decreases, focal laser plus aflibercept if vissual acuity decreases, or anti-VEGF treatment. It is appropriate to defer treatment until visual acuity is worse than 20/25. Deferral of photocoagulation for a brief period of medical treatment may be considered in these cases. Also, deferral of NCI-DME treatment is an option when the visual acuity is excellent (better than 20/32), close follow-up is possible, and the patient understands the risks.

‡ Or at shorter intervals if signs approaching those of severe NPDR appear.

References:

1. Writing Committee for the Diabetic Retinopathy Clinical Research Network. Panretinal photocoagulation vs intravitreous ranibizumab for proliferative diabetic retinopathy: a randomized clinical trial. JAMA 2015;314:2137–46.

2. Olsen, TW. Anti-VEGF pharmacotherapy as an alternative to panretinal laser photocoagulation for proliferative diabetic retinopathy. JAMA 2015;314:2135–6.

Idiopathic Epiretinal Membrane and Vitreomacular Traction (Initial Evaluation and Therapy)

Initial Exam (Key elements)

- Ocular history (e.g., posterior vitreous detachment, uveitis, retinal breaks, retinal vein occlusions, proliferative diabetic retinopathy, ocular inflammatory diseases, recent wound healing)
- Duration of symptoms (e.g., metamorphopsia, difficulty using both eyes together, and diplopia)
- Race/ethnicity
- Systemic history

Physical Exam (Key elements)

- Slit-lamp biomicroscopy the macula, vitreoretinal interface, and optic disc
- An indirect peripheral retinal examination
- Amsler grid test and/or Watzke-Allen test
- OCT to diagnose and characterize VMA, ERM, VMT, and associated retinal changes
- Fluorescein angiogram or OCTA may be helpful to evaluate ERMs and/or VMT

Management Plan

- The decision to intervene surgically in patients with ERM/VMT usually depends upon the severity of symptoms, especially the impact on daily activities
- Patients should be informed that the majority of ERMs will remain stable and do not require therapy
- Patients should be reassured that there is a very successful surgical procedure that could address worsening symptoms or decreasing visual acuity
- Risks versus benefits of vitrectomy surgery should be discussed. Risks include decreased visual acuity, cataract, retinal tears, retinal detachment, and endophthalmitis

Surgery and Postoperative Care

- Vitrectomy surgery is often indicated in patients who are affected with a decrease in visual acuity, metamorphopsia, and double vision or difficulty using their eyes together
- Patients should be examined postoperatively day 1, and again 1 to 2 weeks following surgery, or sooner depending upon the development of new symptoms or new findings during early postoperative examination

Follow-up Physical Exam:

- Internal history
- Measurement of IOP
- Slit lamp biomicroscopy of anterior segment
- Indirect binocular ophthalmoscopy of peripheral retina
- Counseling on use of post op medications
- Counseling on signs and symptoms of retinal detachment
- Precautions on intraocular gas if used

Patient Education and Follow-up

- Comparing OCT images in the abnormal versus normal eye can aid patient understanding
- Patients should be encouraged to periodically test their central vision monocularly to detect changes that may occur over time, like increasing metamorphopsia small central scotoma
- Patients should be informed to notify their ophthalmologist promptly if they have symptoms such as an increase of floaters, loss of visual field, metamorphopsia, or a decrease in visual acuity
- Patients with functionally limiting postoperative visual impairment should be referred for vision rehabilitation (see www.aao.org/low-vision-and-vision-rehab) and social services

Idiopathic Macular Hole (Initial Evaluation and Therapy)

Initial Exam History (Key elements)

- Duration of symptoms
- Ocular history: glaucoma, retinal detachment or tear, other eye diseases, eye or head or injuries, ocular surgery, or sun or eclipse gazing or use of a laser pointer or other laser
- Medications that may be related to macular cystoid edema (e.g., systemic niacin, topical prostaglandin analogues, tamoxifen)

Examination (Key elements)

- Slit-lamp biomicroscopic examination of the macula and the vitreoretinal interface
- Indirect peripheral retinal examination
- Amsler grid test and/or Watzke-Allen test

Ancillary Test

- OCT offers detailed information about the macular anatomy size if an FTMH is present, and presence of any VMT or epiretinal membrane

Management Recommendations for Macular Hole

Stage	Management	Follow-up
1-A and 1-B	Observation	• Follow-up at 2–4 month intervals in the absence of new symptoms • Recommend prompt return if new symptoms develop • Encourage monocular visual acuity testing with Amsler grid
2	Pneumatic Vitreolysis*	• Performed usually within 1 to 2 weeks of diagnosis • Follow up at 1-2 days, then 1 week or sooner if new visual symptoms • Frequency and timing of subsequent visits varies depending on the outcome of surgery and the patient's clinical course
2	Vitreoretinal surgery	• Performed usually within 1 month of diagnosis to minimize risk of progression of macular hole and vision loss • Follow-up at 1–2 days postoperatively, then 1–2 weeks during which strict face down positioning is advised • Frequency and timing of subsequent visits varies depending on the outcome of surgery and the patient's clinical course
2	Vitreopharmacolysis‡	• Performed usually within 1 to 2 weeks of diagnosis • Follow-up at 1 week and 4 weeks, or with new symptoms (i.e., retinal detachment symptoms)
3 or 4	Vitreoretinal surgery	• Performed usually within 1 month of diagnosis • Follow-up at 1–2 days postoperatively, then 1–2 weeks with strict face down positioning if advised • Frequency and timing of subsequent visits varies depending on the outcome of surgery and the patient's clinical course

* Several small case series have shown promising results with this technique for smaller holes

‡ Ocriplasmin has been approved by the U.S. Food and Drug Administration for symptomatic vitreomacular adhesion. There is no evidence to support its use for treatment of idiopathic macular hole without vitreomacular traction or adhesion and this would be considered off-label use.

Surgical and Postoperative Care if Patient Receives Treatment

- Patients should be informed about relative risks, benefits, and alternatives to surgery, and the need for use of expansile intraocular gas or facedown positioning postoperatively
- Formulate a postoperative care plan and inform the patient of these arrangements
- Patients should be informed of possible postoperative increase in IOP
- Examine postoperatively within 1 or 2 days and again 1 to 2 weeks after surgery
- Components of follow-up visit should include interval history, visual acuity measurement, measurement of IOP, slit-lamp biomicroscopy of the anterior chamber and central retina, and indirect ophthalmoscopy of the peripheral retina, and OCT evaluation to document post-op macular anatomy when indicated

Idiopathic Macular Hole (Initial Evaluation and Therapy) *(continued)*

Patient Education

- Patients should be informed to notify their ophthalmologist promptly if they have symptoms such as an increase in floaters, a loss of visual field, metamorphopsia, or a decrease in visual acuity
- Patients should be informed that air travel, travel to higher or lower altitudes, or general anesthesia with nitrous oxide should be avoided until the gas tamponade is nearly completely gone
- Patients who have had a macular hole in one eye should be informed that they have a 10% to 15% chance of macular hole formation in the fellow eye, especially if the vitreous remains attached
- Patients with functionally limiting postoperative visual impairment should be referred for vision rehabilitation (see www.aao.org/low-vision-and-vision-rehab) and social services

Posterior Vitreous Detachment, Retinal Breaks and Lattice Degeneration (Initial and Follow-up Evaluation)

Initial Exam History (Key elements)
- Symptoms of PVD
- Family history of RD, related genetic disorders (e.g., Stickler syndrome)
- Prior eye trauma
- Myopia
- History of ocular surgery including refractive lens exchange and cataract surgery
- History of YAG laser capsulotomy
- History of intravitreal injection

Ophthalmic Exam (Key elements)
- Confrontation visual field examination
- Visual acuity testing
- Pupillary assessment for the presence of a relative afferent pupillary defect
- Examination of the vitreous for hemorrhage, detachment, and pigmented cells
- Examination of the peripheral fundus using scleral depression. The preferred method of evaluating peripheral vitreoretinal pathology is with indirect ophthalmoscopy combined with scleral depression.

Diagnostic Tests
- Optical coherence tomography may be helpful to evaluate and stage the PVD
- Perform B-scan ultrasonography if peripheral retina cannot be evaluated.
- If no abnormalities are found, frequent follow-up examinations are recommended (i.e., every 1-2 weeks initially).

Management:
- Patients should be informed about the relative risks, benefits, and alternatives to surgery
- Formulate a postoperative care plan and inform patient of these arrangements
- Patients should be advised to contact ophthalmologist promptly if they have a substantial change in symptoms such as floaters, peripheral visual field loss, or decreased visual acuity

Follow-up History
- Visual symptoms
- Interval history of eye trauma, intraocular injection, or intraocular surgery

Follow-up Physical Exam
- Visual acuity
- Evaluation of the status of the vitreous, with attention to the presence of pigment, hemorrhage, or syneresis
- Examination of the peripheral fundus with scleral depression or a fundus contact or non-contact lens using the slit-lamp biomicroscope
- Wide-field photography may help but does not replace careful ophthalmoscopy
- Optical coherence tomography if vitreomacular traction is present
- B-scan ultrasonography if the media are opaque

Patient Education
- Patients at high risk of developing retinal detachment should be educated about the symptoms of PVD and retinal detachment and the value of periodic follow-up exams
- Patients who undergo refractive surgery should be informed they remain at risk of RRD despite reduction of their refractive error

Care Management

Management Options

Type of Lesion	Treatment*
Acute symptomatic horseshoe tears	Treat promptly
Acute symptomatic operculated holes	Treatment may not be necessary
Acute symptomatic dialyses	Treat promptly
Traumatic retinal breaks	Usually treated
Asymptomatic horseshoe tears (without subclinical RD)	Consider treatment unless there are signs of chronicity
Asymptomatic operculated tears	Treatment is rarely recommended
Asymptomatic atrophic round holes	Treatment is rarely recommended
Asymptomatic lattice degeneration without holes	Not treated unless PVD causes a horseshoe tear
Asymptomatic lattice degeneration with holes	Usually does not require treatment
Asymptomatic dialyses	No consensus on treatment and insufficient evidence to guide management
Eyes with atrophic holes, lattice degeneration where the fellow eye has had an RD	No consensus on treatment and insufficient evidence to guide management

PVD = posterior vitreous detachment; RD = retinal detachment

*There is insufficient evidence to recommend prophylaxis of asymptomatic retinal breaks for patients undergoing cataract surgery.

Retinal and Ophthalmic Artery Occlusions (Initial Evaluation and Therapy)

History (Key elements)

- Duration of vision loss
- Symptoms of GCA (e.g., vision loss, headaches, scalp tenderness, malaise, fatigue, temporal tenderness, jaw claudication, weakness, fever, myalgia, and diplopia)
- Medications
- Family history of cardiovascular disease, diabetes, systemic hypertension, or hyperlipidemia
- Medical history (e.g., systemic hypertension, diabetes, hyperlipidemia, cardiovascular disease, hemoglobinopathy and polymyalgia rheumatica) or drug history (e.g., cocaine)
- Ocular history (e.g., trauma, other eye diseases, ocular injections, surgery)
- Social history (e.g., smoking)

Physical Exam (Key elements)

- Visual acuity
- Slit-lamp biomicroscopy
- IOP
- Gonioscopy when IOP is elevated or when iris neovascularization risk is suspected (prior to dilation)
- Relative afferent pupil defect assessment
- Slit-lamp biomicroscopy of the posterior pole
- Examination of the peripheral retina using indirect ophthalmoscopy through a dilated pupil to assess: retinal hemorrhages, cotton-wool spots, retinal emboli, retinal vascular "boxcarring," and optic disc neovascularization and/or neovascularization elsewhere

Diagnostic Tests

- Color and red-free fundus photography
- OCT
- Fluorescein angiography
- Indocyanine green angiography
- Ultrasonography in the setting of significant media opacity (to rule out other acute causes of vision loss)

Care Management

- Physicians should first consider GCA in patients 50 years of age or older
- In cases of GCA, physicians should consider urgent systemic corticosteroid therapy to prevent vision loss in the fellow eye or vascular occlusion elsewhere
- Diabetics with GCA should be carefully monitored since systemic corticosteroid treatment may destabilize glucose control
- Ophthalmologists should refer patients with retinal vascular disease to the appropriate setting, depending on the nature of the retinal occlusion
- Acute, symptomatic OAO, CRAO, and BRAO from embolic etiologies should prompt an immediate referral to the nearest stroke center for prompt assessment for consideration of intervention
- When presented with an asymptomatic BRAO, clinicians should conduct a systemic evaluation (careful medical history, assessment for systemic disease), preferably in conjunction with the patient's internist

Patient Follow-up

- Follow-up should consider the extent of retinal or ocular ischemia neovascularization. Patients with greater ischemia require more frequent follow-up
- Many patients with retinal vascular disease will lose substantial vision despite various treatment options and should be referred for appropriate social services and vision rehabilitation (see www.aao.org/low-vision-and-vision-rehab)
- Follow-up evaluation includes a history (symptoms, systemic conditions) and examination (visual acuity, slit-lamp biomicroscopy with iris examination, IOP, undilated gonioscopy for iris neovascularization, biomicroscopic exam of posterior pole after dilation, peripheral retinal vitreous exam when indicated, OCT imaging when appropriate, fluorescein angiography)
- Patients with asymptomatic BRAO could be referred to a primary care physician

Retinal Vein Occlusions (Initial Evaluation and Therapy)

Initial Exam (Key elements)

- Location and duration of vision loss
- Current medications
- Medical history (e.g., systemic hypertension, diabetes, hyperlipidemia, cardiovascular disease, sleep apnea, coagulopathies, thrombotic disorders, pulmonary embolus)
- Ocular history (e.g., glaucoma, other ophthalmologic disorders, ocular injections, surgery, including retinal laser treatment, cataract surgery, refractive surgery)

Physical Exam (Key elements)

- Visual acuity
- Pupillary assessment for relative afferent pupillary defect that corresponds to level of ischemia and predictive risk for neovascularization
- Slit-lamp biomicroscopy for fine, abnormal, new iris vessels
- Measurement of IOP
- Gonioscopy prior to dilation; especially in cases of an ischemic CRVO, when IOP is elevated, or when iris neovascularization risk is high
- Binocular funduscopic evaluation of the posterior pole
- Examination of the peripheral retina and vitreous. Slit-lamp biomicroscopy with appropriate lenses is recommended to evaluate retinopathy of the posterior pole and midperipheral retina. Examination of the far peripheral retina is best performed using indirect ophthalmoscopy

Diagnostic Tests

- Color red-free fundus photography for documenting the severity of the retina findings, NVE, extent of intravitreal hemorrhages and NVD
- Optical coherence tomography to detect the presence and extent of macular edema, vitreoretinal interface changes and subretinal fluid
- Optical coherence tomography angiography to detect capillary nonperfusion, enlarged foveal avascular zone, and vascular abnormalities
- Fluorescein angiography to evaluate extent of vascular occlusion, degree of ischemia, and extent of macular edema
- Ultrasonography (e.g., when vitreous hemorrhage is present)

Care Management

- Optimizing control of diabetes mellitus, hypertension, hyperlipidemia, and IOP are important to manage risk factors
- Systemic reviews have shown the efficacy of anti-VEGF agents in treating macular edema associated with RVO *(I++, GQ, SR)*
- Laser treatment remains a viable treatment in eyes with BRVO, even if the duration of the disease is greater than 12 months
- Sectoral pan retinal photocoagulation is still recommended for neovascularization when complications such as vitreous hemorrhage or iris neovascularization occur
- Ophthalmologists caring for patients with retinal vascular occlusion should be familiar with specific recommendations of relevant clinical trials due to the complexity of diagnosis and treatment

Patient Follow-up

- Follow-up evaluation includes a history of changes in symptoms and systemic status (pregnancy, blood pressure, serum cholesterol, and blood glucose) and examination (visual acuity, undilated slit-lamp biomicroscopy and gonioscopy) monthly for 6 months with CRVO and in eyes with ischemic CRVO after discontinuing anti-VEGF to detect neovascularization, pupillary assessment for a relative afferent pupillary defect, measurement of IOP, stereoscopic exam of posterior pole after dilation, OCT imaging when appropriate, and peripheral retina and vitreous exam when indicated
- Ophthalmologist should refer patients with an RVO to a primary care physician for appropriate management of their systemic condition and communicate results to the physician managing the patient's ongoing care
- Risk to the fellow eye should be communicated to both the primary care provider and the patient
- Patients whose conditions fail to respond to therapy and when further treatment is unavailable should be provided with professional support and offered a referral for counseling, vision rehabilitation, or social services as appropriate (www.aao.org/low-vision-and-vision-rehab)

Cataract (Initial and Follow-up Evaluation)

Initial Exam History (Key elements)

- Symptoms
- Ocular history
- Systemic history
- Assessment of visual function status
- Medications currently used

Initial Physical Exam (Key elements)

- Visual acuity with current correction
- Measurement of BCVA (with refraction when indicated)
- External examination
- Ocular alignment and motility
- Glare testing when indicated
- Pupil reactivity and function
- Measurement of IOP
- Slit-lamp biomicroscopy, including gonioscopy
- Dilated examination of the lens, macula, peripheral retina, optic nerve, and vitreous through a dilated pupil
- Assessment of relevant aspects of the patient's medical and physical status

Care Management

- Treatment is indicated when visual function no longer meets the patient's needs and cataract surgery provides a reasonable likelihood of quality-of-life improvement
- Cataract removal is also indicated when there is evidence of lens-induced disease or when it is necessary to visualize the fundus in an eye that has the potential for sight
- Surgery should not be performed under the following circumstances:
  - Tolerable refractive correction provides vision that meets the patient's needs and desires; surgery is not expected to improve visual function, and no other indication for lens removal exists
  - The patient cannot safely undergo surgery because of coexisting medical or ocular conditions
  - Appropriate postoperative care cannot be arranged
  - Patient or patient's surrogate decision maker is unable to give informed consent for nonemergent surgery
- Indications for second eye surgery are the same as for the first eye (with considerations given to needs for binocular function)
- The standard of care in the United States is a small-incision phacoemulsification with foldable IOL implantation with either biaxial or coaxial approach *(I+, GQ, SR)*

Preoperative Care

The ophthalmologist who is to perform the surgery has the following responsibilities:

- Examine the patient preoperatively
- Ensure that the evaluation accurately documents symptoms, findings, and indications for treatment
- Inform the patient about the risks, benefits, and expected outcomes of surgery, including the anticipated refractive outcome or surgical experience
- Formulate surgical plan, including selection of IOL and anesthesia
- Review results of presurgical and diagnostic evaluations with the patient
- Inform the patient about the possibility of visual impairment continuing after cataract surgery, and the potential for rehabilitation *(III, GQ, SR)*
- Formulate postoperative plans and inform patient of arrangements
- Answer patient's questions regarding surgery, care, and cost
- Routine preoperative laboratory testing in association with the history and physical examination is not indicated *(I+, GQ, SR)*

Follow-up Evaluation

- High-risk patients should be seen within 24 hours of surgery
- Routine patients should be seen within 48 hours of surgery
- Frequency and timing of subsequent visits depend on refraction, visual function, and medical condition of the eye
- More frequent follow-up usually necessary for high risk patients
- Components of each postoperative exam should include:
  - Interval history, including new symptoms and use of postoperative medications
  - Patient's assessment of visual function status
  - Measurement of IOP
  - Slit-lamp biomicroscopy
  - Operating ophthalmologist should provide postoperative care that is within the unique competence of the ophthalmologist *(III, GQ, SR)*

Cataract (Initial and Follow-up Evaluation) *(continued)*

Nd:YAG Laser Capsulotomy

- Treatment is indicated when vision impaired by posterior capsular opacification does not meet the patient's functional needs or when it critically interferes with visualization of the fundus
- Educate about the symptoms of posterior vitreous detachment, retinal tears, and detachment and the need for immediate examination if these symptoms are noticed
- The decision to perform capsulotomy should take into account the benefits and risks of the laser surgery. Laser posterior capsulotomy should not be performed prophylactically (i.e., when the capsule remains clear). The should be inflammatory-free and the IOL stable prior to performing Nd:YAG laser capsulotomy. *(III, GQ, SR)*

Bacterial Keratitis (Initial Evaluation)

Initial Exam History

- Ocular symptoms (e.g., degree of pain, redness, discharge, blurred vision, photophobia, duration of symptoms, circumstances surrounding the onset of symptoms)
- Contact lens history (e.g., wearing schedule, overnight wear, type of contact lenses, contact lens solution, contact lens hygiene protocol, tap-water rinse of contact lenses, swimming, using a hot tub, or showering while wearing contact lenses, method of purchase, such as over the internet, and decorative contact lens use.)
- Review of other ocular history, including risk factors such as herpes simplex virus keratitis, varicella zoster virus keratitis, previous bacterial keratitis, trauma, dry eye, and previous ocular surgery, including refractive and facial (including laser cosmetic) surgery
- Review of other medical problems, including immune status, systemic medications, and history of MRSA.
- Current and recently used ocular medications
- Medication allergies

Initial Physical Exam

- Visual acuity
- General appearance of patient, including skin conditions
- Facial examination
- Globe position
- Eyelids and eyelid closure
- Conjunctiva
- Nasolacrimal apparatus
- Corneal sensation
- Slit-lamp biomicroscopy
  - Eyelid margins
  - Conjunctiva
  - Sclera
  - Cornea
  - Anterior chamber for depth and the presence of inflammation, including cell and flare, hypopyon, fibrin, hyphema
  - Anterior vitreous for the presence of inflammation
  - Contralateral eye for clues to etiology as well as possible similar underlying pathology

Diagnostic Tests

- Manage majority of community-acquired cases with empiric therapy and without smears or cultures.
- Indications for smears and cultures:
  - Corneal infiltrate that is central, large, and/or associated with significant stromal involvement.
  - Chronic or unresponsive to broad spectrum antibiotic therapy.
  - History of corneal surgeries
  - Atypical clinical features suggestive of fungal, amœbic, or mycobacterial keratitis.
  - Infiltrates are in multiple locations on the cornea.
- The hypopyon that occurs in eyes with bacterial keratitis is usually sterile, and aqueous or vitreous taps should not be performed unless there is a high suspicion of microbial endophthalmitis, such as following an intraocular surgery, perforating trauma, or sepsis.
- Corneal scrapings for culture should be inoculated directly onto appropriate culture media to maximize culture yield. If this is not feasible, place specimens in transport media. In either case, immediately incubate cultures or take promptly to the laboratory.

Care Management

- Topical antibiotic eye drops are capable of achieving high tissue levels, a preferred method of treatment in most cases.
- Single-drug therapy using a fluoroquinolone is as effective as combination therapy utilitizing fortified antibiotics *(I+, GQ, SR)* There is no difference found in corneal perforation rates across classes of topical antibiotics *(I+, GQ, SR)*
- Topical corticosteroid therapy may have a beneficial role, but much of the literature has not shown a difference in clinical outcome *(I+, GQ, SR)*
- Subconjunctival antibiotics may be helpful where there is imminent scleral spread or perforation or where adherence is questionable.
- For central or severe keratitis (e.g., deep stromal involvement or an infiltrate larger than 2 mm with extensive suppuration), use a loading dose (e.g., every 5 to 15 minutes), followed by frequent applications (e.g., every hour is recommended.) Severe cases should be followed daily initially, at least until stable or improvement is confirmed.
- Systemic therapy may be useful in cases of scleral or intraocular extension of infection of systemic infection such as gonorrhea.
- For patients treated with ocular topical corticosteroids at time of presentation of suspected bacterial keratitis, reduce or eliminate corticosteroids until infection has been controlled.
- When the corneal infiltrate compromises the visual axis, may add topical corticosteroid therapy following at least 2 to 3 days of progressive improvement with treatment with topical antibiotics typically after pathogen identification.
- Examine patients within 1 to 2 days after initiation of topical corticosteroid therapy and monitor intraocular pressure.
- In general, modify the initial regimen if there is lack of improvement or stabilization within 48 hours.

Bacterial Keratitis (Management Recommendations)

Patient Education

- Inform patients with risk factors predisposing them to bacterial keratitis of their relative risk, the signs and symptoms of infection, and to consult an ophthalmologist promptly if they experience such warning signs or symptoms
- Educate about the severe visual impairment from bacterial keratitis and need for strict adherence to the therapeutic regimen
- Discuss possibility of permanent visual loss and need for future visual rehabilitation
- Educate patients with contact lenses about increased risk of infection associated with contact lens, overnight wear, and importance of adherence to techniques to promote contact lens hygiene
- Refer patients with significant visual impairment or blindness for vision rehabilitation if they are not surgical candidates (see www.aao.org/low-vision-and-vision-rehab)

Antibiotic Therapy of Bacterial Keratitis

Organism	Topical Antibiotic	Topical Concentration	Subconjunctival Dose
No organism identified or multiple types of organisms	Cefazolin or Vancomycin with Tobramycin or gentamicin or Fluoroquinolones*	25-50 mg/ml 9–14 mg/ml Various†	100 or 25 mg in 0.5 ml 20 mg in 0.5 ml
Gram-positive Cocci	Cefazolin Vancomycin‡ Bacitracin‡ Fluoroquinolones*	50 mg/ml 10–50 mg/ml 10,000 IU Various†	100 mg in 0.5 ml 25 mg in 0.5 ml
Gram-negative Rods	Tobramycin or gentamicin Ceftazidime Fluoroquinolones	9–14 mg/ml 50 mg/ml Various†	20 mg in 0.5 ml 100 mg in 0.5 ml
Gram-negative Cocci§	Ceftriaxone Ceftazidime Fluoroquinolones	50 mg/ml 50 mg/ml Various†	100 mg in 0.5 ml 100 mg in 0.5 ml
Gram-positive Rods (Nontuberculous Mycobacteria)	Amikacin Clarithromycin Azithromycin‖ Fluoroquinolones	20–40 mg/ml 10 mg/ml 10 mg/ml Various†	20 mg in 0.5 ml
Gram-positive Rods (Nocardia)	Sulfacetamide Amikacin Trimethoprim/ Sulfamethoxazole: Trimethoprim Sulfamethoxazole	100 mg/ml 20–40 mg/ml 16 mg/ml 80mg/ml	 20 mg in 0.5 ml

Modified with permission from the American Academy of Ophthalmology Basic and Clinical Science Course Subcommittee. Basic Clinical and Science Course. External Disease and Cornea: Section 8, 2017-2018. Table 10-6. San Francisco: American Academy of Ophthalmology, 2017.

* Fewer gram-positive cocci are resistant to gatifloxacin, moxifloxacin, and besifloxacin than other fluoroquinolones.

† Besifloxacin 6mg/ml; ciprofloxacin 3 mg/ml; gatifloxacin 3 mg/ml; levofloxacin 15 mg/ml; moxifloxacin 5 mg/ml; ofloxacin 3 mg/ml, all commercially available at these concentrations

‡ For resistant *Enterococcus* and *Staphylococcus* species and penicillin allergy. Vancomycin and bacitracin have no gram-negative activity and should not be used as a single agent in empirically treating bacterial keratitis.

§ Systemic therapy is necessary for suspected gonococcal infection.

‖ Data from Chandra NS, Torres MF, Winthrop KL. Cluster of *Mycobacterium chelonae* keratitis cases following laser in-situ keratomileusis. Am J Ophthalmol 2001; 132(6):819–30.

Blepharitis (Initial and Follow-up Evaluation)

Initial Exam History

- Ocular symptoms and signs (e.g., redness, irritation, burning, tearing, itching, crusting of eyelashes, loss of eyelashes, eyelid sticking, blurring or fluctuating vision, contact lens intolerance, photophobia, increased frequency of blinking and recurrent hordeolum)
- Time of day when symptoms are worse
- Duration of symptoms
- Unilateral or bilateral presentation
- Exacerbating conditions (e.g., smoke, allergens, wind, contact lenses, low humidity, retinoids, diet and alcohol consumption, eye makeup)
- Symptoms related to systemic diseases (e.g., rosacea, atopy, psoriasis, and graft-versus-host disease [GVDH])
- Current and previous systemic and topical medications (e.g., antihistamines or drugs with anticholinergic effects, or drugs used in the past that might have an effect on the ocular surface [e.g., isotretinoin])
- Recent exposure to an infected individual (e.g., pediculosis palpebrarum [*Pthirus pubis*])
- Ocular history (e.g., previous intraocular and eyelid surgery, local trauma, including mechanical, thermal, chemical, and radiation injury, history of cosmetic blepharoplasty, history of styes and/or chalazia)

Initial Physical Exam

- Visual acuity
- External examination
  - Skin
  - Eyelids
- Slit-lamp biomicroscopy
  - Tear film
  - Anterior eyelid margin
  - Eyelashes
  - Posterior eyelid margin
  - Tarsal conjunctiva (everting eyelids)
  - Bulbar conjunctiva
  - Cornea

Diagnostic Tests

- Cultures may be indicated for patients with recurrent anterior blepharitis with severe inflammation as well as for patients who are not responding to therapy.
- Biopsy of the eyelid to exclude the possibility of carcinoma may be indicated in cases of marked asymmetry, resistance to therapy or unifocal recurrent chalazia that do not respond well to therapy.
- Consult with the pathologist prior to obtaining the biopsy if sebaceous cell carcinoma is suspected.

Care Management

- Treat patients with blepharitis initially with a regimen of warm compresses and eyelid cleansing.
- A topical antibiotic such as bacitracin or erythromycin can be prescribed to be applied one or more times daily or at bedtime on the eyelid margins for a few weeks.
- For patients with meibomian gland dysfunction, whose chronic symptoms and signs are not adequately controlled with eyelid cleansing or meibomian gland expression, oral tetracyclines and topical antibiotics may be helpful.
- Topical azelaic acid, topical ivermectin, brimonidine, doxycycline, and isoretinoin are effective treatments for patients with systemic rosacea. *(I+, GQ, SR)*
- A brief course of topical corticosteroids may be helpful for eyelid or ocular surface inflammation such as severe conjunctival infection, marginal keratitis, or phlyclenules. The minimal effective dose of corticosteroid should be utilized and long-term corticosteroid therapy should be avoided if possible.
- An eyelid tumor should be suspected in patients with atypical eyelid-margin inflammation or disease not responsive to medical therapy, and these patients should be carefully re-evaluated.

Follow-Up Evaluation

- Follow-up visits should include:
  - Interval history
  - Measurement of visual acuity
  - External examination
  - Slit-lamp biomicroscopy
- If corticosteroid therapy is prescribed, re-evaluate patient within a few weeks to determine the response to therapy, measure intraocular pressure, and assess treatment compliance

Patient Education

- Counsel patients about the chronicity and recurrence of the disease process.
- Inform patients that symptoms can frequently be improved but are rarely eliminated.
- Patients with an inflammatory eyelid lesion that appears suspicious for malignancy should be referred to an appropriate specialist.

Conjunctivitis (Initial Evaluation)

Initial Exam History

- Ocular symptoms and signs (e.g., mattering and adherence of eyelids, itching, tearing, discharge, irritation, pain, photophobia, blurred vision)
- Duration of symptoms and time course
- Exacerbating factors
- Unilateral or bilateral presentation
- Character of discharge
- Recent exposure to an infected individual
- Trauma (mechanical, chemical, ultraviolet)
- Recent surgery
- Mucus fishing behavior (i.e., repetitive manipulation and wiping of the conjunctiva leading to mechanical irritation)
- Contact lens wear (lens type, hygiene and use regimen)
- Symptoms and signs potentially related to systemic diseases (e.g., genitourinary discharge, dysuria, dysphagia, upper respiratory infection, skin and mucosal lesions)
- Allergy, asthma, eczema
- Use of topical and systemic medications
- Ocular history (e.g., previous episodes of conjunctivitis and previous ophthalmic surgery)
- Compromised immune status (e.g., HIV, chemotherapy, immunosuppressents)
- Current and prior systemic diseases (e.g., atopy, SJS/TEN, carcinoma, leukemia, chickenpox, GVHD)
- Social history (e.g., smoking habits, exposure to second hand smoke, occupation and hobbies, exposure to air pollutants, travel, exercise habits, diet, use of illicit drugs, and sexual activity)

Initial Physical Exam

- Visual acuity
- External examination
  - Regional lymphadenopathy, particularly preauricular
  - Skin (signs of rosacea, eczema, seborrhea)
  - Abnormalities of the eyelids and adnexae (swelling, discoloration, malposition, laxity, ulceration, nodules, ecchymosis, neoplasia, lateral flare, lash loss)
  - Orbits: fullness, asymmetry
  - Conjunctiva (laterality, type of conjunctival reaction, distribution, subconjunctival hemorrhage, chemosis, cicatricial change, symblepharon, masses, discharge)
- Slit-lamp biomicroscopy
  - Eyelid margins (inflammation, edema, hyperpigmentation, meibomian gland dysfunction, ulceration, discharge, nodules or vesicles, blood-tinged debris, keratinization)
  - Eyelashes (loss of lashes, crusting, scurf, mites, nits, lice, trichiasis)
  - Lacrimal puncta and canaliculi (pouting, discharge, edema)
  - Tarsal and forniceal conjunctiva
  - Bulbar conjunctiva/limbus (follicles, edema, nodules, chemosis, laxity, papillae, ulceration, scarring, phlyctenules, hemorrhages, foreign material, keratinization)
  - Cornea
  - Dye-staining pattern (conjunctiva and cornea)
  - Anterior chamber/iris (inflammation reaction, synechiae, transillumination defects)

Diagnostic Tests

- Cultures, smears for cytology and special stains are indicated in cases of suspected infectious neonatal conjunctivitis.
- Smears for cytology and special stains are recommended in cases of suspected infectious neonatal conjunctivitis, chronic or recurrent conjunctivitis, and gonococcal conjunctivitis in any age group.
- Confirm diagnosis of adult and neonate chlamydial conjunctivitis with laboratory testing.
- Biopsy the bulbur conjunctiva and take a sample from an eye with active inflammation when ocular mucous membrane pemphigoid is suspected.
- A full-thickness lid biopsy is indicated in cases of suspected sebaceous carcinoma.
- Thyroid function tests are indicated for patients with SLK who do not have known thyroid disease.

Conjunctivitis (Management Recommendations)

Care Management

- The majority of cases in the adult popoulation are viral and self-limited, and do not require antimicrobial treatment. There is no proven effective treatment for eradication of adenovial infection; artificial tears, topical antihistamines, topical steroids, oral analgesics or cold compresses may mitigate symptoms. The use of antibiotics should be avoided because of potential adverse treatment effects.
- Allergen-specific immunotherapy is beneficial in reducing allergic conjunctivitis, more in children than in adults *(I+, GQ, SR)*
- Treat mild allergic conjunctivitis with an over-the-counter antihistamine/vasoconstrictor agent or second-generation topical histamine H1-receptor antagonists. *(I+, GQ, SR)* If the condition is frequently recurrent or persistent, use mast-cell stabilizers *(I++, GQ, SR)*
- Treatment for vernal/atopic conjunctivitis include modifying the environment and use of cold compresses and ocular lubricants. For acute exacerbations, topical corticosteroids are usually needed. Topical cyclosporine is shown to be effective for severe cases. *(I+, GQ, SR)*
- For contact lens-related keratoconjunctivitis, discontinue contact lens wear until the cornea returns to normal
- In severe cases, topical cyclosporine or tacrolimus can be considered *(I+GQ, DR)*
- Use systemic antibiotic treatment for conjunctivitis due to *Neisseria gonorrhoeae* or *Chlamydia trachomatis*
- Treat sexual partners to minimize recurrence and spread of disease when conjunctivitis is associated with sexually transmitted diseases and refer patients and their sexual partners to an appropiate medical specialist
- Refer patients with manifestation of a systemic disease to an appropriate medical specialist

Follow-Up Evaluation

- Follow-up visits should include
  - Interval history
  - Visual acuity
  - Slit-lamp biomicroscopy
- If corticosteroids are used, perform periodic measurement of intraocular pressure and pupillary dilation to evaluate for cataract and glaucoma

Patient Education

- Counsel patients with contagious varieties to minimize or prevent spread of disease and encourage minimization of contact with other people for 10 to 14 days after onset of symptoms *(I+, GQ, SR)* in the community
- Inform patients who may require repeat short-term therapy with topical corticosteroid of potential complications of corticosteroid use
- Advise patients with allergic conjunctivitis that frequent clothes washing and bathing/showering before bedtime may be helpful

Corneal Ectasia (Initial and Follow-up Evaluation)

Initial Exam History

- Disease onset and course
- Vision impairment
- Ocular, medical, and family history

Initial Physical Exam

- Visual function assessment
- External examination
  - Eyelids and eyelid skin
- Slit-lamp biomicroscopy
  - Presence, extent, and location of corneal thinning or protrusion
  - Indication of previous ocular surgery
  - Presence of Vogt striae, prominent corneal nerves, Fleischer ring, or other iron deposition
  - Evidence of corneal scarring or previous hydrops, and presence of prominent corneal nerves
- IOP measurement
- Fundus examination: assessment of red reflex for dark area, and retina for tapetoretinal degenerations

Diagnostic Tests

- Keratometry
- Corneal topography and tomography
  - Topographic power map
  - Topographic elevation map and tomography
- Optical coherence tomography (OCT)

Care Management

- Therapy is tailored to the individual patient, depending on the visual impairment and a risk/benefit analysis of each treatment option(s).
- Vision can be corrected with eyeglasses, but contact lenses may be required as keratoconus progresses to correct vision and reduce distortion.
- Rigid corneal gas permeable contact lenses can mask corneal irregularities. Hybrid contact lenses provide higher oxygen permeability and greater RGP/hydrogel junction strength. Piggyback contact lenses may be employed for greater comfort and less epithelial disruption. Scleral lenses may be indicated when RGP and/or hybrid contact lenses fail.
- Intrastromal corneal ring segment implantation can improve contact lens tolerance and BCVA for patients with corneal ectasia, a clear cornea, and contact lens intolerance.
- Cross-Linking (CXL) has long term data supporting its safety and stability and should be considered for patients with early Keratoconus and at risk of progression to arrest or slow progression in its earliest stage.
- Lamellar keratoplasty using DALK techniques can be considered for contact-lens-intolerant patients without significant scarring at Descemets membrane or persistent hydrops. Crescentic lamellar keratoplasty is an option when maximal thinning is in the cornea's periphery.
- Penetrating keratoplasty is indicated when a patient can no longer achieve functional vision with eyeglasses and contact lenses and CXL is contraindicated, or when persistent corneal edema occurs following hydrops. Descemet stripping endothelial keratoplasty cannot correct ectatic disorder.
- Penetrating keratoplasty (PK) is preferred over DALK in cases of deep stromal scarring. Overall, there is insufficient evidence to determine which tecnique offers better overall outcomes. *(I+, GQ, DR)*
- A lamellar graft can be performed for tectonic support when ectasia occurs in the far periphery of the cornea and additional PK can be performed for visual rehabilitation.

Follow-Up Evaluation

- Follow-up visits should include:
  - Interval history
  - Visual acuity
  - External examination
  - Slit-lamp biomicroscopy
  - Assessment of corneal contour and thickness by topography and tomography
  - Measurement of corneal thickness
- With the advent of CXL, more frequent follow-up (i.e., 3-6 months) for progression is now indicated.

Patient Education

- Counsel all patients to avoid eye rubbing.
- Discuss the benefits and potential risks of early crosslinking in patients at high risk for progression or who historically have noted progressive loss of vision.
- Patients undergoing corneal transplantation should be made aware of the warning signs of rejection and should seek medical attention promptly if symptoms occur. The practitioner should be aware of the slit-lamp biomicroscopic findings of epithelial, stromal, and endothelial rejection.

Corneal Edema and Opacification (Initial Evaluation)

Initial Exam History

- Symptoms and signs: blurred or variable vision often with a diurnal character; photophobia; redness; tearing; intermittent foreign body sensation; intense, disabling, or task-disrupting pain
- Recent history of other ocular surgery
- Age of onset
- Rapidity of onset: acute symptoms vs. gradual or fluctuating
- Persistence: transient or permanent
- Unilateral or bilateral presentation
- Moderating factors or situations
- Past ocular and medical history
- Topical and systemic medications
- Trauma: blunt or penetrating injury to eye or periocular region, forceps delivery, chemical injury
- Contact lens wear: rationale, type of lens, wear time, and cleaning routine
- Family and social history

Initial Physical Exam

- Visual function assessment
  - Comparison of visual acuity measurement and functional status
  - Glare testing
- External examination
  - Evidence of proptosis, ptosis, lagophthalmos, or floppy eyelid syndrome
  - Eyelid or facial asymmetry, scarring, and malfunction
  - Miscellaneous (e.g., pupil responses, corneal diameter, dry eye evaluation)
- Slit-lamp biomicroscopy
  - Unilateral or bilateral signs
  - Diffuse or localized edema
  - Primarily epithelial or stromal edema
  - Evidence of epithelial breakdown, stromal infiltration, epithelial ingrowth, striae, focal thickening, thinning, scarring, interface haze, striae or inflammation, or stromal vascularization or deposits
  - Evidence of guttae, Descemet's membrane tear or detachment, endothelial vesicles, keratic precipitates (KP), pigment, peripheral anterior synechiae
  - Involvement of host tissue, if there is a corneal transplant
  - Evidence of sectoral corneal edema and a cluster line of KP, or an anterior chamber reaction
  - Status, shape, and position of the pupil and iris
  - Status and position of the crystalline lens or IOL and any other intraocular device
  - Evidence of past keratorefractive procedures
  - Healed or recent corneoscleral wounds, areas of scleral thinning associated with previous surgery, surgical devices, and signs of intraocular inflammation.
- IOP measurement
- Fundus examination
- Gonioscopy

Diagnostic Tests

- Potential acuity meter
- Rigid contact lens over-refraction
- Pachymetry
- Topography
- Specular microscopy
- Confocal microscopy
- Anterior segment optical coherence tomography
- Ultrasound biomicroscopy

Corneal Edema and Opacification (Management Recommendations)

Care Management

- Therapeutic goal is to control the cause of corneal edema or opacity and enhance a patient's quality of life by improving visual acuity and comfort
- In most cases treatment starts with medical management, when this is insufficient, surgery may be considered
- Corneal edema: medical management
  - Lowering an elevated IOP is helpful
  - Topical carbonic anhydrase inhibitors should not be the first line of therapy when endothelial dysfunction is suspected
  - Topical corticosteroid can control inflammation once infection has been ruled out or controlled
  - Microcystic or bullous epithelial disease may produce discomfort or pain necessitating the placement of a bandage contact. Thin lenses with high water content and high oxygen diffusion coefficients may be the most advantageous.
  - Supportive management should be initiated to reduce inflammation and/or pain in cases of acute hydrops
- Corneal edema: surgical management
  - Patients with corneal edema and persistent discomfort, but limited or no visual potential, are generally better candidates for the following procedures:
    - Conjunctival flap
    - Amniotic membrane transplantation
    - A number of scarification procedures
    - Corneal transplantation
    - Endothelial keratoplasty
  - For patients wtih persistent corneal edema, a number of keratectomy and keratoplasty procedures can be considered.
- Corneal opacification: medical management
  - Corneal opacity treatment can be divided into two phases: a) management of the principal, initiating process (i.e., infection, trauma), and b) management of the resulting problems (i.e., surface erosions and irregularity, scarring, thinning, and vascularization)
  - Conventional treatment involves an antibiotic drop or ointment to protect against secondary bacterial infection
  - Temporary tarsorraphy with botulinum toxin, or suture can be helpful when blinking or lid closure is inadequate
  - A bandage contact lens or amniotic membrane may be useful in cases of delayed healing
  - Pressure patching used to be standard treatment, but a recent study found that this does not positively impact comfort or speed of healing *(I+, GQ, DR)*
  - Progressive thinning of cornea or a small perforation usually requires structural support with application of a tissue adhesive.
  - Topical corticosteroids are often used to reduce intraocular and corneal inflammation. IOP and cataract formation should be monitored with long-term topical corticosteroid use.
  - A rigid gas permeable lens — or hybrid or scleral lens when greater stability is needed — will often improve vision when surface irregularity is a factor; such lenses may preclude the need for more invasive procedures
- Corneal opacification: surgical management
  - Surgical strategy for managing corneal opacities depends on the tissue layer(s) involved:
    - Superficial keratectomy may be indicated for removal of superficial deposits
    - Lamellar keratoplasty may be indicated for removal of deeper deposits
    - Penetrating keratoplasty may be indicated for removal of even deeper multilevel opacities
    - Ethylenediaminetetraacetic acid (EDTA) may be used to remove calcific band keratopathy *(III, IQ, DR)*

Follow-Up Evaluation

- In the management of corneal edema, the goal of follow up is to monitor endothelial dysfunction
- In the management of corneal opacification, follow up to monitor corneal clarity and degree of surface irregularity is necessary
- Coexisting problems, particularly intraocular inflammation and IOP, need regular reassessment

Patient Education

- Provide an understanding of balanced expectations of the amount of visual function that can realistically be preserved or recovered and risk of complications.
- Detailed discussion of the causes of edema or opacity, and various treatment options, is important.
- When the disease process or management is complex, every effort should be made to counsel the patient regarding such challenges to allow for appropriate expectations and informed decision-making.
- There is a commercially available point-of-care test to identify Avellino dystrophy in keratorefractive surgery candidates if either family history or clinical findings are inconclusive for this condition.

Dry Eye Syndrome (Initial Evaluation)

Initial Exam History

- Ocular symptoms and signs (e.g., irritation, tearing, burning, stinging, dry or foreign body sensation, mild itching, photophobia, blurry vision, contact lens intolerance, redness, mucous discharge, increased frequency of blinking, eye fatigue, diurnal fluctuation, symptoms that worsen later in the day)
- Exacerbating conditions (e.g., wind, air travel, decreased humidity, prolonged visual efforts associated with decreased blink rate such as reading and using the computer)
- Duration of symptoms
- Ocular history, including
  - Topical medications used and their associated preservatives (e.g., artificial tears, eyewash, antihistamines, glaucoma medications, vasoconstrictors, corticosteroids, antiviral medications, homeopathic or herbal preparations)
  - Contact lens history
  - Allergic conjunctivitis
  - Ocular surgical history (e.g., prior keratoplasty, cataract surgery, keratorefractive surgery)
  - Ocular surface disease (e.g., herpes simplex virus, varicella zoster virus, ocular mucous membrane pemphigoid, aniridia)
  - Punctal surgery
  - Eyelid surgery (e.g. prior ptosis repair, blepharoplasty, entropion/ectropion repair)
  - Bell's palsy
- Medical history, including
  - Smoking or exposure to second-hand smoke
  - Dermatological diseases (e.g., rosacea, psoriasis, varicella zoster virus)
  - Technique and frequency of facial washing including eyelid and eyelash hygiene
  - Atopy
  - Systemic inflammatory diseases (e.g., Sjögren syndrome, graft-versus-host disease, rheumatoid arthritis, systemic lupus erythematosus, Stevens-Johnson syndrome, sarcoidosis, scleroderma)
  - Other systemic conditions (e.g., lymphoma, sarcoidosis)
  - Systemic medications (e.g., antihistamines, diuretics, hormones and hormonal antagonists, antidepressants, cardiac antiarrhythmic drugs, isotretinoin, diphenoxylate/atropine, beta-adrenergic antagonists, chemotherapy agents, any other drug with anticholinergic effects)
  - Trauma (e.g., mechanical, chemical, thermal)
  - Chronic viral infections (e.g., hepatitis C, human immunodeficiency virus)
  - Nonocular surgery (e.g., bone marrow transplant, head and neck surgery, trigeminal neuralgia surgery)
  - Radiation of orbit
  - Neurological conditions (e.g., Parkinson disease, Bell's palsy, Riley-Day syndrome, trigeminal neuralgia)
- Nonocular symptoms (dry mouth, dental cavities, oral ulcers, fatigue, joint pain, muscle aches, menopause)

Initial Physical Exam

- Visual acuity
- External examination
  - Skin (e.g., scleroderma, facial changes consistent with rosacea, seborrhea)
  - Eyelids: incomplete closure/malposition, incomplete or infrequent blink, eyelid lag or retraction, erythema of eyelid margins, abnormal deposits or secretions, entropion, ectropion
  - Adnexa: enlargement of the lacrimal glands
  - Proptosis
  - Cranial nerve function (e.g., cranial nerve V [trigeminal], cranial nerve VII [facial])
  - Hands: joint deformities characteristic of rheumatoid arthritis, Raynaud phenomenon, splinter hemorrhages underneath nails
- Slit-lamp biomicroscopy
  - Tear film: height of the meniscus, debris, increased viscosity, mucus strands, and foam, break-up time and pattern
  - Eyelashes: trichiasis, distichiasis, madarosis, deposits
  - Anterior and posterior eyelid margins: abnormalities of meibomian glands (e.g., orifice metaplasia, reduced expressible meibum, atrophy), character of meibomian gland secretions (e.g., turbid, thickened, foamy, deficient), vascularization crossing the mucocutaneous junction, keratinization, scarring, eyelid margin hyperemia
  - Puncta: patency, position, presence, and position of plugs
  - Conjunctiva
    - Inferior fornix and tarsal conjunctiva (e.g., mucous threads, scarring, erythema, papillary reaction, follicle enlargement, keratinization, subepithelial fibrosis, foreshortening, symblepharon)
    - Bulbar conjunctiva (e.g., punctate staining with rose bengal, lissamine green, or fluorescein dyes; hyperemia; localized drying; keratinization, chemosis, chalosis, follicles)
  - Cornea: localized interpalpebral drying, punctate epithelial erosions assessed with fluorescein dyes, punctate staining with rose bengal or fluorescein dyes, filaments, epithelial defects, basement membrane irregularities, mucous plaques, keratinization, pannus formation, thinning, infiltrates, ulceration, scarring, neovascularization, evidence of corneal or refractive surgery

Dry Eye Syndrome (Management Recommendations)

Diagnostic Tests

- Tear Break-up Time
- Ocular Surface Dye Staining
- Schirmer Test
- Fluorescein Dye Disappearance Test/Tear Function Index
- Tear Osmolarity Test

Care Management

- Treat any causative factors that are amenable to treatment as patients with dry eye symptoms often have many contributory factors
- Specific therapies may be chosen from any category (see Table) regardless of the level of disease severity, depending on physician experience and patient preference
- Artificial tears are safe and effective *(I+, GQ, SR)*
- Corticosteroids can decrease ocular irritation symptoms, decrease corneal fluorescein staining, and improve filamentary keratitis *(I+, GQ, SR)*
- Silicone plugs may provide symptomatic relief in patients with severe dry eye *(I+, GQ, DR)*
- Autologous serum tears may improve ocular irritation symptoms compared with artificial tears in the short-term
- For mild dry eye, the following measures are appropriate:
  - Education and environmental modifications
  - Elimination of offending topical or systemic medications
  - Aqueous enhancement using artificial tear substitutes, gels/ointments
  - Eyelid therapy (warm compresses and eyelid hygiene)
  - Treatment of contributing ocular factors such as blepharitis or meibomianitis
  - Correction of eyelid abnormalities
- For moderate dry eye, in addition to above treatments, the following measures are appropriate:
  - Anti-inflammatory agents (topical cyclosporine and corticosteroids, systemic omega-3 fatty acids supplements)
  - Punctal plugs
  - Spectacle side shields and moisture chambers
- For severe dry eye, in addition to above treatments, the following measures are appropriate:
  - Systemic cholinergic agonists
  - Systemic anti-inflammatory agents
  - Mucolytic agents
  - Autologous serum tears
  - Contact lenses
  - Correction of eyelid abnormalities
  - Permanent punctal occlusion
  - Tarsorrhaphy
- Monitor patients prescribed corticosteroids for adverse effects such as increased intraocular pressure, and cataract formation

Follow-Up Evaluation

- Purpose is to assess response to therapy as a basis for altering or adjusting treatment as necessary, to monitor for ocular surface damage, and to provide reassurance.
- Frequency and extent will depend on the severity of disease, therapeutic approach and response to therapy.

Patient Education

- Patient education is an important aspect of successful management
- Counsel patients about the chronic nature of dry eye and its natural history.
- Set and discuss realistic expectations for therapeutic goals
- Provide specific instructions for therapeutic regimens.
- Reassess periodically the patient's compliance and understanding of the disease, risks for associated structural changes and realistic expectations for effective management, and reinforce education.
- Refer patients with manifestation of a systemic disease to an appropriate medical specialist.
- Caution patients with pre-existing dry eye that keratorefractive surgery, particularly LASIK, may worsen their dry eye condition.

Amblyopia (Initial and Follow-up Evaluation)

Initial Exam History (Key elements)

- Ocular symptoms and signs
- Ocular history
- Systemic history, birth weight, gestational age, prenatal and perinatal history, past hospitalizations and operations, and general health and development
- Family history of eye conditions and relevant systemic diseases

Initial Physical Exam (Key elements)

- A Binocular red reflex (Brückner) test
- Binocularity/stereoacuity testing
- Assessment of visual acuity and/or fixation pattern
- Binocular alignment and ocular motility
- Cycloplegic retinoscopy/refraction with subjective refinement when indicated
- Funduscopic examination

Care Management

- All children with amblyopia should be offered an attempt at treatment regardless of age
- Choose treatment based on patient's age; visual acuity; adherence and response to previous treatment; and physical, social, and psychological status
- Treatment goal is equal visual acuity between the two eyes
- Once maximal visual acuity has been obtained, treatment should be tapered and eventually stopped

Follow-Up Evaluation

- Follow-up visits should include:
  - Interval history
  - Adherence to treatment plan
  - Side effects of treatment
  - Visual acuity of each eye
- Follow-up examination generally arranged 2 to 3 months after initiation of treatment
- Timing varies according to intensity of treatment and age of child
- Continued monitoring required because about one-fourth of children successfully treated experience a recurrence within the first year after treatment has stopped

Patient Education

- Discuss diagnosis, severity of disease, prognosis and treatment plan with patient, parents and/or caregivers
- Explain the disorder and recruit the family in a collaborative approach to therapy

Esotropia (Initial and Follow-up Evaluation)

Initial Exam History (Key elements)

- Ocular symptoms and signs
- Ocular history (date of onset and frequency of the deviation, presence or absence of diplopia, squinting, closing one eye, or other visual symptoms)
- Systemic history, birth weight, gestational age, prenatal and perinatal history, past hospitalizations and operations, and general health and development
- Family history (strabismus, amblyopia, type of eyeglasses and history of wear, extraocular muscle surgery, or other eye surgery, and genetic diseases)
- Social history (e.g., grade level in school, learning difficulties, behavior problems, or issues with social interactions)

Initial Physical Exam (Key elements)

- Verification of eyeglass correction with a lensometer
- Binocular alignment at distance and near in primary gaze, up and down gaze, and horizontal gaze positions, if possible; if eyeglasses are worn, alignment testing should be performed with correction
- Extraocular muscle function (ductions and versions, including incomitance such as found in some A and V patterns)
- Detection of latent or manifest nystagmus
- Sensory testing, including fusion and stereoacuity
- Cycloplegic retinoscopy/refraction
- Fundoscopic examination
- Monocular and binocular optokinetic nystagmus testing for nasal-temporal pursuit asymmetry

Care Management

- Consider all forms of esotropia for treatment and re-establish binocular alignment as soon as possible
- Prescribe corrective lenses for any clinically significant refractive error as initial treatment
- If eyeglasses and amblyopia management are ineffective in aligning the eyes, then surgical correction is indicated
- Start amblyopia treatment before surgery because surgical treatment of esotropia in the presence of moderate to severe amblyopia has a lower success rate than in the presence of mild or no amblyopia

Follow-Up Evaluation

- Periodic evaluations necessary because of risk of developing amblyopia losing binocular vision, and recurrence
- Children who are well-aligned and do not have amblyopia may be followed every 4 to 6 months
- Frequency of follow-up visits can be reduced as the child matures
- New or changing findings may indicate need for more frequent follow-up examinations
- Hyperopia should be assessed at least annually and more frequently if visual acuity decreases or esotropia increases
- Repeat cyclopegic refraction is indicated when esotropia does not respond to initial prescription of hyperopic refraction or when esotropia recurs after surgery

Patient Education

- Discuss findings with the patient when appropriate and/or parents/caregivers to enhance understanding of disorder and to recruit them in a collaborative approach to therapy
- Formulate treatment plans in consultation with the patient and/or family/caregivers

Exotropia (Initial and Follow-up Evaluation)

Initial Exam History (Key elements)

- Ocular symptoms and signs
- Ocular history (date of onset and frequency of the deviation, presence or absence of diplopia, squinting, closing one eye, or other visual symptoms)
- Systemic history, birth weight, gestational age, prenatal and perinatal history, past hospitalizations and operations, and general health and development
- Family history (strabismus, amblyopia, type of eyeglasses and history of wear, extraocular muscle surgery, or other surgery, and genetic diseases)
- Social history (e.g., grade level in school, learning difficulties, behavior problems, or issues with social interactions)

Initial Physical Exam (Key elements)

- Sensory testing, including fusion and stereoacuity
- Verification of eyeglass correction with a lensometer
- Binocular alignment at distance and near in primary gaze, up and down gaze, and horizontal gaze positions, if possible; if eyeglasses are worn, alignment testing should be performed with correction
- Extraocular muscle function (ductions and versions, including incomitance such as found in some A and V patterns)
- Detection of latent or manifest nystagmus
- Cycloplegic retinoscopy/refraction
- Fundoscopic examination
- Monocular and binocular optokinetic nystagmus testing for nasal-temporal pursuit asymmetry

Care Management

- All forms of exotropia should be monitored and some will require treatment
- Young children with intermittent exotropia and good fusional control can be followed without surgery
- Deviations that are present most or all of the time require treatment
- Prescribe corrective lenses for any clinically significant refractive error that caused reduced vision in one or both eyes
- Optimal therapy for exotropia, the long-term benefit of early surgical correction, and the relative merits of bilateral versus unilateral surgery are not well established
- Amblyopia is uncommon in patient with intermittent exotropia, but, if present, should be treated

Follow-up Evaluation

- Frequency of follow-up evaluations is based on age of child, ability to obtain an accurate visual acuity, and control of the deviation
- Children with good fusional control of intermittent exotropia and without amblyopia are typically examined every 6 to 12 months
- By age 7 to 10 years, the frequency of exams may be reduced
- Includes frequency of deviation, adherence to treatment (if any), and assessment of ocular motility and update of refractive correction, if needed

Patient Education

- Discuss findings with the patient when appropriate and/or parents/caregivers to enhance understanding of disorder and recruit them in a collaborative approach to therapy
- Formulate treatment plans in consultation with the patient and/or family/caregivers

Keratorefractive Surgery (Initial and Follow-up Evaluation)

Initial Exam History

- Present status of visual function
- Ocular history
- Systemic history
- Medications

Initial Physical Exam

- Distance visual acuity with and without correction
- Manifest, and when appropriate, cycloplegic refraction
- Computerized corneal topography/tomography
- Central corneal thickness measurement
- Evaluation of tear film and ocular surface
- Evaluation of ocular motility and alignment

Care Management

- Discontinue contact lenses before preoperative exam and procedure
- Inform patient of the potential risks, benefits, and alternatives to and among the different refractive procedures
- Document informed consent process; patient should be given an opportunity to have all questions answered before surgery
- Check and calibrate instrumentation before the procedure
- Surgeon confirms the identity of the patient, the operative eye, and that the parameters are correctly entered into the laser's computer

Postoperative Care

- Operating surgeon is responsible for postoperative management
- For surface ablation techniques, examination on the day following surgery is advisable and every 2 to 3 days thereafter until the epithelium is healed
- For uncomplicated LASIK, examine within 36 hours following surgery, a second visit 1 to 4 weeks post-operatively, and further visits thereafter as appropriate
- Provide patients with a record or that the ophthalmologist maintains a record that lists the patient's eye condition, including preoperative keratometry readings and refraction, as well as stable postoperative refractions, so that it will be available if the patient requires cataract surgery or additional eye care

Patient Education

Discuss the risks and benefits of the planned procedure with the patient. [A:III] Elements of the discussion include the following:

- Range of expected refractive outcomes
- Residual refractive error
- Reading and/or distance correction postoperatively
- The limitations of keratorefractive surgery with respect to presbyopia and the potential loss of uncorrected near visual function that accompanies myopia correction
- Monovision advantages and disadvantages (for patients of presbyopic age)
- Loss of best-corrected visual acuity
- Side effects and complications (e.g., microbial keratitis, sterile keratitis, keratectasia)
- Changes in visual function not necessarily measured by visual acuity testing, including glare and function under low-light conditions
- Night vision symptoms (e.g., glare, haloes) developing or worsening; careful consideration should be given to this issue for patients with high degrees of ametropia or for individuals who require a high level of visual function in low-light conditions
- Effect on ocular alignment
- Development or exacerbation of dry eye symptoms
- Recurrent erosion syndrome
- Advantages and disadvantages of same-day bilateral keratorefractive surgery versus sequential surgery. Because vision might be poor for some time after bilateral same-day photorefractive keratectomy, the patient should be informed that activities such as driving might not be possible for weeks.
- Possibility that it may influence predictive accuracy of IOL calculations for subsequent cataract surgery
- Postoperative care plans (setting of care, providers of care)
- Loss of uncorrected near vision in myopic presbyopes

Adult Strabismus with a History of Childhood Strabismus*

Initial Exam History

- Ocular misalignment
- Strabismus angle and direction
- History of chronicity, review past clinical, surgical and imaging records

Initial Physical Exam

- Optical corrections and presence of ground-in or overlay prism, and impact current correction has on alignment
- Manifest refraction to identify barriers to binocular alignment or fusion
- Assessment of alignment by light reflex testing (e.g., Krimsky) to compare with cover test and identification of abnormal angle kappa
- Dry manifest and cycloplegic refraction, providing clues to original oculomotor disturbance
- Complete motility examination, including cover-uncover, alternate-cover testing, testing for binocular fusion and stereopsis.
- Inspection of the ocular surface for conjunctival scars (prior incision sites) and exposure of the thinned sclera behind anatomical insertions (evidence of likely muscle recession)
- Inspection of the interpalpebral fissures for evidence of prior vertical or horizontal rectus muscle resection (smaller interpalpebral fissure) or recession (larger interpalpebral fissure)
- Prism testing to simulate desired postsurgical alignment and range of overcorrection and undercorrection comfortably tolerated and unlikely to result in diplopia
- Assessment for ocular torsion by sensory testing or anatomic evidence of torsion noted during indirect ophthalmoscopy, particularly in patients with vertical strabismus
- Imaging (e.g., CT, MRI, orbital ultrasound) although nearly all cases can be managed without imaging

Management Plan

- Patient should be monitored/observed if symptoms are mild, occasional, and well tolerated or if patient is opposed to treatment
- Consider if alignment might be improved with changing optical correction (e.g., correction of hyperopia and appropriate bifocal or progressive lenses for adults approaching presbyopia)
- Reversal of monovision may be necessary and may resolve symptoms
- Prisms to address some forms of diplopia, and orthoptic exercises to address some forms of diplopia and asthenopia can be considered

Surgical and Postoperative Care

- Correction of childhood strabismus in adults is generally surgical but, because a broad range of conditions may be responsible, specifics of surgery will vary
- Surgery is often challenging because of pre-existing surgical scarring, uncertainty about extraocular muscle attributes and location, possible limited fusional skills
- Sequelae of previous surgery should be addressed to optimize postoperative alignment

Patient Education and Follow-up

- Patients should be informed about the disorder and management options, as well as the adaption to the new ocular alignment resulting from surgery
- Inform the patient's other health care providers about the diagnosis and treatment plan

* Please refer to the Adult Strabismus Preferred Practice Patterns for care process of other forms of adult strabismus