

Review of Hygiene and Disinfection Recommendations for Outpatient Glaucoma Care: A COVID Era Update

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Abstract: This review focuses on best practices and recommendations for hygiene and disinfection to limit exposure and transmission of infection in outpatient glaucoma clinics during the current COVID-19 pandemic.

Key Words: coronavirus, disinfection, hygiene, glaucoma, tonometry, visual field testing, optical coherence tomography, lenses

(*J Glaucoma* 2020;29:409–416)

The first physician to sound the alarm about the novel coronavirus causing severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was ophthalmologist Lin Wenliang, MD in Wuhan, China. Not long after he first raised awareness for SARS-CoV-2, he was infected by a presymptomatic patient with glaucoma and died.¹

Just a few months after Dr Wenliang's death, several studies have confirmed both presymptomatic and asymptomatic transmission of SARS-CoV-2^{2–5} and the director of the Centers for Disease Control and Prevention (CDC) Dr Robert Redfield estimates that as many as 25% of individuals who test positive for COVID-19 disease are asymptomatic.⁶ Hence, the fear of transmission of SARS-CoV-2 during an ophthalmology office visit is well warranted and requires ophthalmologists, optometrists, and ancillary personnel to be aware of the signs and symptoms of COVID-19; and to minimize transmission to personnel and other patients.

Reports have suggested that COVID-19 may present with findings of conjunctivitis that are indistinguishable from viral conjunctivitis because of other pathogens. A study of 30 patients in China found that 1 patient with conjunctivitis had SARS-CoV-2 in tear film and conjunctival discharge, suggesting that the virus may cause infection through the conjunctiva or ocular surfaces.⁷ In a study of 38 patients with clinically confirmed COVID-19, ocular findings such as conjunctival hyperemia and epiphora were associated with more severe clinical disease, higher white blood cell, and neutrophil counts, and greater

C-reactive protein elevation compared with patients without ocular symptoms.⁸ Though the risk of ocular transmission of SARS-CoV-2 through the tear film is likely low,⁹ the use of ophthalmic diagnostic equipment and procedures that requires close proximity to patients—such as the slit lamp, ophthalmoscope, and ocular manipulation—increases the risk of viral transmission from patient to physician through respiratory droplets and contact with surfaces. In addition, several ophthalmic instruments are commonly used during a single-patient visit and, if not disinfected properly, these tools can become potential sources of transmission.

There were nearly 46.3 million office visits to ophthalmologists in the United States in 2016 according to the most recent CDC National Ambulatory Medical Care Survey.^{10,11} Glaucoma, 1 of the top 5 reasons for office visits, accounted for 7.19 million visits in the United States in 2016.¹¹ The large volume of annual office visits to outpatient glaucoma clinics combined with the use of ophthalmic tools and the necessary proximity of physicians to patients during these visits puts both patients and health care workers at considerable risk for exposure to pathogens. Moreover, patients visiting a glaucoma clinic are often older adults with comorbidities,^{12,13} the demographic at highest risk of severe illness from COVID-19.¹⁴

How can glaucoma specialists adjust their practice to best protect themselves from exposure to SARS-CoV-2 and avoid becoming a vector for transmission to patients and staff? Through an internet search and communication with ophthalmic equipment manufacturers, we have compiled recommendations for hygiene and disinfection in outpatient glaucoma clinics as a reference guide. The Ophthalmology Department at Columbia University implemented many of these practices before the American Academy of Ophthalmology (AAO) or the CDC-published guidelines for outpatient care. Following the development of an operational task force at Columbia University, the Ophthalmology Department shared several commonsense measures for practice operations starting March 2. The department has continued to be proactive in adjusting best practices for ophthalmology clinics, and these updated protocols and policies, including a Patient Visit Stratification, are publicly available on the department's COVID-19 Information webpage.¹⁵

PREVENTING PERSON TO PERSON TRANSMISSION IN GLAUCOMA OUTPATIENT SETTINGS

The primary mode of transmission of SARS-CoV-2 is thought to be person to person spread in respiratory droplets when an infected person coughs, sneezes, or talks.¹⁶ To limit respiratory spread during office visits, ophthalmologists must take precautions to regulate the number of patients entering clinic, to preserve social (physical)

Received for publication April 13, 2020; accepted April 17, 2020.
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Supported by Bernard and Shirlee Brown Glaucoma Research Laboratory, Edward S. Harkness Eye Institute, Columbia University Irving Medical Center, New York, NY and an unrestricted grant from Research to Prevent Blindness, New York, NY (Columbia University Department of Ophthalmology).

Disclosure: The authors declare no conflict of interest.

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DOI: 10.1097/IJG.0000000000001540

distancing, and to minimize direct encounters between staff and patients.^{17–20}

The CDC has published guidelines for health care facilities to protect patients and staff during the current SARS-CoV-2 outbreak.²¹ These recommendations include screening patients for symptoms of acute respiratory illness—including cough or shortness of breath, sore throat, or systemic symptoms like myalgias or chills—and advising patients to check their temperature before their arrival at the health care facility, asking all patients about history of travel to areas with high prevalence of COVID-19 or contact with possible COVID-19 positive individuals, separating patients with respiratory symptoms from other patients in the waiting area, optimizing the use of telemedicine, limiting the number of staff providing care, installing barriers to limit contact with patients during triage, and emphasizing hand hygiene for patients and staff.^{22,23}

On March 18, 2020, the AAO published “New Recommendations for Urgent and Nonurgent Patient Care,”²⁴ urging ophthalmologists to halt providing any treatment that is nonurgent or nonemergent. The AAO is continually updating their guidelines for practice management specific to ophthalmology. In addition to the aforementioned CDC recommendations, AAO recommendations include the following²⁴:

- Reschedule appointments for patients with nonurgent ophthalmic problems and see only patients with emergent needs or those requiring frequent management.
- Only allow patients inside the practice; if necessary, a patient may have only 1 person to accompany them.²⁵
- Encourage online payment of copays to minimize interaction between patients and health care staff.
- Use slit lamp breath shields.
- Both patient and physicians should speak as little as possible during slit lamp examination.
- For patients with documented COVID-19, persons under investigation, or patients who are “potentially infected with COVID-19,” ophthalmologists should wear personal protective equipment (PPE) including an N95 mask, gown, gloves, and eye protection.

Although the CDC suggests implementing PPE optimization strategies to extend supplies,²⁶ at the moment this review was performed, the AAO has not yet offered an official stance on the use and reuse of PPE. The recommendations and expectations for the use of PPE in the outpatient glaucoma clinics must be considered in the context of the United States’ PPE shortage. For example, N95 masks are not currently readily available for outpatient health care settings, so the AAO has not yet recommended the use of N95 masks in outpatient clinics. CDC guidance should be followed and accessed frequently given our constantly changing knowledge of disease transmission. The purpose of this review is to provide a resource for the disinfection of instruments and devices of particular interest to the glaucoma specialist.

DISINFECTION OF THE CLINIC ENVIRONMENT: WAITING ROOM AND PATIENT ROOMS

Another important mode of transmission of COVID-19 may be spread from contact with contaminated surfaces or objects.¹⁶ To minimize disease transmission through surfaces in the outpatient health care setting, both the CDC and AAO recommend routine cleaning and disinfection of waiting rooms, restrooms, examination lanes, office furniture,

and instruments.^{23,27} For example, within the Ophthalmology Department at Columbia University, cleaning of check-in and check-out kiosks, front desk workstations, door entries, and waiting room furniture is performed hourly.²⁸

The AAO suggests following CDC recommendations for appropriate disinfectant agents, which include: diluted household bleach (> 1000 ppm sodium hypochlorite), alcohol solutions with at least 70% alcohol, and common EPA-registered household disinfectants (eg, surface wipes with dimethyl benzyl ammonium chloride, such as Clorox and Lysol branded products).²⁷ The EPA published an official list of products that meet criteria for use against SARS-CoV-2 and includes the required amount of time that a surface should be treated with each product to effectively kill the virus.²⁹

DISINFECTION OF EQUIPMENT AND OTHER INSTRUMENTS IN GLAUCOMA CLINICS

Another potential vector of transmission in glaucoma clinics is any device used during patient visits. Slit lamps are commonly discussed in the context of viral transmission given the close proximity of patient to provider and patient-instrument contact during the physical examination. The AAO has encouraged the use of slit lamp breath shields, and several manufacturers including Zeiss and Topcon are offering free slit lamp breath shields. There are also many videos and picture demonstrations on the internet for how to make functional slit lamp breath shields using materials that are easily accessible, such as an A4 plastic folder or a plastic quilting template. Other ophthalmic devices such as handheld tonometers have been implicated in the transmission of viral pathogens as well.³⁰

On April 2, 2020, the AAO recommended using the “same disinfection practices already used” to disinfect ophthalmic instruments and office furniture.²⁷ In order to confirm manufacturers’ disinfection instructions and to provide a reference tool for glaucoma specialists as they continue to see patients in the outpatient setting, customer support lines of several manufacturers were contacted, and we conducted a comprehensive review of manufacturer webpages and equipment user manuals.

We have compiled the cleaning and disinfection instructions from manufacturers for the following ophthalmic tools that are commonly used in outpatient glaucoma clinics: visual field analyzers (Table 1), optical coherence tomography (OCT) machinery (Table 2), tonometers (Table 3), and lenses (Table 4). Each table is inclusive of commonly used products from a sample of manufacturers but is not meant to be an exhaustive list nor an endorsement of the listed products. The information provided herein is publicly available as of April 5, 2020 on manufacturer websites or as downloadable PDF documents.

VISUAL FIELD TESTING

Visual Field Analyzers of all types require close contact of the patient to the equipment and close proximity of the operator to the patient and equipment (including data entry and patient positioning). Aspects of the equipment that come into direct contact with the patient include the forehead and chin rests, the patient response button, the chair, and the eye occluder. The corrective lens may also come into contact with the patient’s eyelashes or nose. Respiratory droplets may accumulate on these surfaces and importantly within the perimetry bowl itself. The duration of viral particle presence on the bowl surface, how long the particles remain suspended within the bowl, and whether the viral particles can be dislodged or resuspended by normal breathing or talking by the patient undergoing testing is

TABLE 1. Summary of Recommendations for the Cleaning and Disinfection of Common Visual Field Analyzers, by Manufacturer

Manufacturer	Haag-Streit Diagnostics	Heidelberg Engineering Inc.	OCULUS Inc.	Carl Zeiss Meditec Inc.
Products	Octopus perimetry 600 Octopus Perimetry 900	Heidelberg Edge Perimeter	Easyfield C Easyfield S Centerfield 2 Smartfield Twinfield 2	Humphrey Field Analyzer 3 Perimetry
Materials for disinfection	Desinset from HAAG-STREIT	Optical surfaces: dry microfiber cloth Never use cleaning tissues or disinfectant wipes to clean the lens Nonoptical surfaces: moist cloth	Pursept-A Xpress (alcohol-based) disinfectant cloths or an equivalent	Liquid Trial Lens: soft cloth or tissue Forehead and chin rests, patient response button, exterior surfaces, touch screen: dampened soft cloth Bowl: cotton-tipped applicator
Agents for disinfection	70% isopropyl alcohol Do not use solvents or abrasive cleaning products	Optical surfaces: isopropyl alcohol with an alcohol level of 70% or ethanol with an alcohol level of 80% Nonoptical surfaces: Metrex CaviWipes or other EPA-registered disinfectants with comparable active substances Follow appropriate infection control guidelines regarding surface disinfectant contact times Do not use products containing acetone or hydrogen peroxide	Do not use aggressive, chlorine-containing abrasive or sharp cleaning agents	Liquid Trial Lens: 70% isopropyl alcohol in water or mild glass cleaner containing no ammonia Forehead and chin rests, patient response button: mild detergent, alcohol wipes Bowl: 70% isopropyl alcohol in water Exterior panels: mild detergent or appliance cleaner Do not spray cleaner directly on the touch screen or exterior surfaces
Frequency of disinfection	Forehead and chin rests, patient response button, eye patch, corrective lenses, and patient-side cover should be disinfected before every examination and after each patient use	Disinfect the device before and after each examination	Disinfect the forehead and chin rests, handheld button, and eyepatch after each examination Disinfect the housing as needed	Disinfect the forehead and chin rests and patient response button after each patient Bowl: disinfect small spots on bowl surface due to patient coughing or sneezing
Links to user manuals for reference	www.haag-streit.com/haag-streit-diagnostics/products/perimetry/octopus-900/ www.haag-streit.com/haag-streit-usa/products/haag-streit-diagnostics/octopus-perimetry/octopus-600/	PDF available upon request from manufacturer	PDF available upon request from manufacturer	www.zeiss.com/content/dam/med/ref_international/corona/pdfs/ifu-cleaning-excerpt-hfa3.pdf www.zeiss.fr/content/dam/Meditec/international/ifu-documents/hfa3/current/2660021166131_a_artwork.pdf

unknown. The eye occluder may be replaced with disposable material such as taped gauze or an amblyopia patch to decrease the amount of time and material used for disinfection between each patient. Disinfection of visual field analyzers including the bowl surface may be difficult, and the AAO previously suggested avoiding the use of “equipment that cannot be safely disinfected, such as some visual field analyzers.”²⁴ Routine perimetry should therefore be performed judiciously and taking into account the aforementioned precautions. A summary of the

recommendations for cleaning and disinfection of visual field analyzers is provided in Table 1.

IMAGING DEVICES (OCT)

Imaging devices’ (eg, OCT or cameras) forehead and chin rests come into direct contact with the patient. The exterior surface of the machine may be contaminated by a patient’s respiratory droplets from breathing or speaking during the examination. A summary of the recommendations for cleaning and disinfection of OCT units is provided in Table 2.

TABLE 2. Summary of Recommendations for the Cleaning and Disinfection of Common Optical Coherence Tomography Devices, by Manufacturer

Manufacturer	Heidelberg Engineering Inc.	Optovue Inc.	Topcon Medical Systems Inc.	Carl Zeiss Meditec Inc.
Products	SPECTRALIS	iVue, iFusion, Avanti, iScan	Maestro 2 Swept Source DRI OCT Triton	CIRRUS 6000 CIRRUS 5000/500
Materials for disinfection	Optical surfaces: dry microfiber cloth Never use cleaning tissues or disinfectant wipes to clean the lens	Ocular (Front Objective) lens: lens cleaning paper Head and chin rest: cloth or cleaning towels, wet isopropyl alcohol cleaning paper pad	Lens: 100% cotton high-performance wipe wrapped around long cotton tip applicator, air puffer	Do not use alcohol prep wipes to clean lenses or optical surfaces Optics: soft, absorbent, lint-free lens tissue wrapped around a cotton swab
Agents for disinfection	Optical surfaces: isopropyl alcohol with an alcohol level of 70% or ethanol with an alcohol level of 80% Nonoptical surfaces: Metrex CaviWipes or other EPA-registered disinfectants with comparable active substances Follow appropriate infection control guidelines regarding surface disinfectant contact times Do not use products containing acetone or hydrogen peroxide	Ocular (Front Objective) lens: diluted acetone or lens cleaning solution Head and chin rest: antigermicide or isopropyl alcohol	Lens: 3M Novec 7200 Engineered Fluid Nonoptical surfaces: disinfecting wipes	Nonoptical surfaces: spectroscopic grade isopropyl alcohol or acetone Strong solvents such as acetone or methyl alcohol will damage the chin cup and forehead rest Lenses: water, isopropyl alcohol, and acetone Do not use alcohol prep wipes to clean lenses or optical surfaces Do not use any cleaning agent on the screen
Frequency of disinfection	Disinfect the device before and after each examination	The headrest pad and chin rest cup should be cleaned before every patient visit Ocular (front objective) lens of the RTVue should be cleaned daily	Not specified	The forehead and chinrests should be cleaned between each examination
Links to user manuals for reference	PDF available upon request from manufacturer	PDF available upon request from manufacturer	www.topconmedical.com/customer-support/instructional.htm	www.zeiss.com/content/dam/med/ref_international/corona/pdfs/ifu-cleaning-excerpt-cirrus-6000.pdf

TONOMETRY

Contact Tonometry

Previous studies have reported that applanation tonometry has the potential to transmit a variety of infectious agents, including adenovirus 8 and herpes simplex virus 1, and reusable tonometer prisms could, in theory, be a mode of transmission for hepatitis B, hepatitis C, human immunodeficiency virus, and Creutzfeldt-Jakob disease.³¹⁻³⁷ A systematic review of 11 studies assessing the disinfection of Goldmann tonometers concluded that there is no definitive optimal technique or agent for the disinfection of Goldmann applanation tonometer prisms.^{30,33} The AAO supports the use of diluted bleach for the disinfection of reusable tonometer tips for SARS-CoV-2 and adenovirus. If available, single use, disposable tonometer prisms provide an alternative to reusable prisms to prevent cross-contamination.³⁸ A summary of the recommendations for cleaning and disinfection of common contact tonometers is provided in Table 3.

Noncontact Tonometry

In its Infection Prevention and Control Recommendations, the CDC suggests taking precautions when performing aerosol-

generating procedures, which could generate the aerosolization of viral particles.²³ A 1991 study using fluorescence photography using specific types of tonometer (Keeler Pulsair and AO NCT II) depicted visible tear film splatter from the air puff in eyes receiving fluorescein drops; however the investigators were unable to demonstrate aerosolization of the tear film in eyes not receiving topical drops.³⁹ Unless aerosolization of the tear film with the puff energy elicited by the current devices is evidenced, non-contact tonometry during the pandemic could be considered after weighing risks and benefits. One potential benefit, for instance, is that these tonometers permit more staff-patient distancing than other methods. When used, care should be taken to properly disinfect contact surfaces between patients.

LENSES

Given their frequent handling, proximity to respiratory droplets and/or direct contact to the eye, diagnostic, or therapeutic lenses [eg, handheld indirect lenses (20D, 28D, 60D, 78D, 90D, etc.) Goldmann-type contact lenses, laser surgery lenses, gonioscopy lenses, and others] are vectors for nosocomial infection during an ophthalmologic examination.^{40,41}

TABLE 3. Summary of Recommendations for the Cleaning and Disinfection of Common Contact Tonometers, by Manufacturer

Manufacturer	Haag-Streit Diagnostics	Icare USA Inc.	Reichert Inc.	Keeler Ltd
Products	AT 900 Goldmann Applanation Tonometer	Icare ic100 Tonometer Icare ic200 Tonometer Icare TA01i	Tono-Pen AVIA Tono-Pen XL Tonometer CT 100 and CT210 Contact Tonometers Ocular Response Analyzer G3 PT100 Portable Noncontact Tonometer Model 30 Pneumatonometer	TonoCare Noncontact Tonometer AccuPen Handheld Tonometer Pulsair intellipuff Tonometer KAT R-Type and T-Type Keeler Applanation Tonometers D-KAT R-Type and T-Type Applanation Tonometers
Materials for disinfection	HAAG-STREIT's Desinset	Damp soft cloth	Soft cloth	Soft nonshedding cloth
Agents for disinfection	Hydrogen peroxide at a 3% aqueous solution or sodium hypochlorite (household bleach) at a 10% aqueous solution Do not use agents containing alcohol or acetone, do not disinfect using UV radiation, do not sterilize using steam or ethylene oxide, and do not expose to temperatures > 60°C	70%-100% isopropyl alcohol, mild soap solution, or 95% Pursept solution Bleach may discolor the handle Never spray, pour or spill liquid onto the Icare tonometer, its accessories, connectors, switches, or openings in the chassis. Dry any liquid on the surface of the tonometer immediately	External surfaces and forehead rest: mild detergent solution (1 cc of liquid dish soap to 1 L of clean, filtered water (filtered below 5 µm) Measurement prism: aqueous hydrogen peroxide solution of 3% Operator display: neutral detergent, isopropyl, or ethanol. Do not use any chemical solvent, acidic, or alkali solution on the operator display PT100: do not use alcohol, methanol, acetone, or any other solvents when cleaning the PT100	Tonometer body: water/detergent solution (2% detergent by volume) or water/isopropyl alcohol solution (70% IPA by volume) Tonometer prisms: Pantasept—3% aqueous solution, hydrogen peroxide 3% aqueous solution, or sodium hypochlorite, 10% aqueous solution Do not disinfect prisms using the following: alcohol, acetone, UV radiation, sterilization, immersion in fluid for > 1 h, temperatures > 60°C TonoCare puff tube lens: water/detergent solution (2% detergent by volume) Avoid using isopropyl alcohol solution on optical surfaces
Frequency of disinfection	Not specified	Clean the forehead and cheek support for each new patient Clean the probe base every 6 mo	Clean Tono-Pen body between patients Measurement prisms should be disinfected before each use	Clean the hand unit daily and between patients Clean and disinfect prism before each use
Links to user manuals for reference	www.haag-streit.com/fileadmin/Haag-Streit_Diagnostics/Tonometry/Instructions_for_use/Disinfection/01-IFU_Desinfektion-7220375-04060_eng_01.pdf www.haag-streit.com/fileadmin/Haag-Streit_Diagnostics/Tonometry/Instructions_for_use/List_of_Disinfectants/SHT_DisinfectionList-7200533-04210.pdf	www.icare-usa.com/wp-content/uploads/2017/10/Icare_Cleaning_Instructions.pdf	http://doclibrary.com/MSCL167/PRM/16170-101-Rev-J-UG-ORAG31553.pdf http://doclibrary.com/MSCL167/PRM/68E3441-Rev-K-XL-UG0700.pdf http://doclibrary.com/MSCL167/PRM/12598-101-Rev-E-CT210-UG3818.pdf	www.keelerusa.com/pub/media/productattachments/files/k/a/kat_ver_d_-_english.pdf www.keelerusa.com/pub/media/productattachments/files/e/P/ep59-70038-art-f_english.pdf www.keelerusa.com/pub/media/productattachments/files/P/u/pulsair_intelipuff_ver_f_-_english.pdf

TABLE 4. Summary of Recommendations for the Cleaning and Disinfection of Common Lenses, by Manufacturer

Manufacturer	Haag-Streit Diagnostics	Ocular Instruments Inc.	Volk Optical Inc.	Katena Products Inc.
Products	Goldmann-type contact lenses Laser contact lenses	Indirect BIO lenses Direct contact laser lenses Suture lysis lenses Ocular koepple diagnostic gonio lenses Lint-free tissues or hospital grade compressed air for drying	Indirect BIO lenses Noncontact slit lamp lenses Direct and indirect contact laser lenses Gonio lenses Soft, lint-free cotton cloth	Diamond contact lenses
Materials for disinfection	Desinset from HAAG-STREIT	For all Ocular Argon/Diode, YAG and Diagnostic Lenses: clean with low foaming mild soap then disinfect with a disinfectant solution approved by the U.S. Food and Drug Administration (FDA), the German Society of Hygiene and Microbiology (DGHM), CE Mark, etc. Pay strict attention to disinfectant manufacturers recommended concentrations and contact durations. To avoid damage to the lens, do not exceed recommended exposure time	2% Aqueous Solution of Glutaraldehyde, 9:1 Sodium hypochlorite, or Cidex OPA. A complete list of approved disinfection agents can be found in the link provided	Tissue
Agents for disinfection	3% aqueous solution of hydrogen peroxide or 10% aqueous solution of sodium hypochlorite (household bleach)	For all Ocular MaxField Glass and MaxLight CR-39 Indirect Diagnostic/Laser Lenses: clean with alcohol wipe, then proceed with disinfection as above	To avoid surface damage to contact lenses, never clean the contact elements with alcohol, peroxide or acetone	Sodium hypochlorite 1% (10,000 ppm of available chlorine)
Frequency of disinfection	Do not use agents containing alcohol or acetone, do not disinfect using UV radiation, and do not sterilize using steam or ethylene oxide, do not expose to temperatures > 60°C Contact lenses may be treated together with each other, but not with any other products Clean and disinfect contact lenses before each use	Each device requires cleaning and disinfection before each use	Instruments should be cleaned as soon as possible after use to minimize the drying of contaminants to the surface	Lenses must be cleaned and disinfected before initial use and between uses. Do not allow the lens to dry after use. Immediately decontaminate the lens after use
Links to user manuals for reference	www.haag-streit.com/fileadmin/Haag-Streit_Diagnostics/Tonometry/Instructions_for_use/Disinfection/01-IFU_Desinfektion-7220375-04060_eng_01.pdf www.haag-streit.com/fileadmin/Haag-Streit_Diagnostics/Tonometry/Instructions_for_use/List_of_Disinfectants/SHT_DisinfectionList-7200533-04210.pdf	https://ocularinc.com/media/wysiwyg/pdf/10781_Cleaning_Method_1_English_Only_Rev_H.pdf https://ocularinc.com/media/wysiwyg/pdf/10781_Cleaning_Method_1_English_Only_Rev_H.pdf	https://volk.com/pdf/CCG-001-Cleaning-and-Care-Guide.pdf	www.katena.com/support/instructions-for-use

In order to limit the number of patients coming into contact with a single lens, many ophthalmology departments, including our own, have suspended the use of trial lenses and trial framing, and are only performing refractions in rare situations.²⁸ Single-use diagnostic or therapeutic lenses, such as those offered by some manufacturers (eg, Volk Optical and Katena), can reduce the potential for transmission of infection and eliminate the time required for disinfection without affecting image quality.^{42,43} Alternatively, Haag-Streit Goldmann lenses can be used with an optically neutral disposable shield call the Stery Cup.⁴⁴ A summary of the recommendations for cleaning and disinfection of lenses commonly used in an office visit for a glaucoma patient is provided in Table 4.

CONCLUSIONS

There are many opportunities for the transmission of pathogens, particularly the coronavirus now causing COVID-19, during a patient visit to an outpatient glaucoma clinic. Proper infection control practices are especially important given the volume of patients in these clinics—even during times of restricted patient flow—and the number of instruments that may be used during a single-patient examination. Careful attention to personal hygiene, social (physical) distancing, and instrument disinfection will decrease the chance of inadvertent transmission among ourselves, office personnel, and patients in the outpatient setting.

By implementing many of these practices in the first week of March, before national organizations gave recommendations for outpatient clinical practices, our department has kept the COVID-19 infection rate among staff and faculty very low. This proactive approach serves as an example for how Ophthalmology Departments can effectively address the next epidemic or pandemic to decrease transmission between patients and providers.

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