Several expensive, complex pieces of equipment are available to eyecare professionals for imaging and diagnosis, but are we making the most of our time-honored, low-cost tools? Contact lenses for imaging, diagnosis, and treatment have been around for decades, the first example of which was described by Goldmann in the 1950s. And while some ODs have embraced these imaging devices, in particular the four-mirror gonioscopy lens, other contact lenses could be of great assistance in optometric practice. Many optometrists regularly make use of non-contact lenses at the slit lamp (such as 90 D or 78 D) or with a head-mounted binocular indirect ophthalmoscope (such as 20 D). Lenses that contact the patient’s eye are less frequently used, possibly because of the need for anesthetic, and in some cases, contact fluid. These lenses have notable advantages that enhance visualization and provide better diagnostic precision. Image quality is better with use of such lenses because the contact endpoint neutralizes the power of the cornea and offsets irregularities such as astigmatism. There are fewer air/optical surface interfaces and consequently losses because aberrations and reflectance are minimized, which improves image contrast. A more extensive view of the fundus is achievable—in particular there is better access to peripheral regions of the fundus and the ability to image the anterior chamber angle. Higher magnification and superior depth discrimination are possible. Inspection through the depths of the vitreous may be accomplished by positioning the focus of the slit lamp in front of the retina. And there is the further benefit of improved eye stabilization during the exam.

Another reason that eyecare professionals may be reluctant to use contact lenses is the vast array of choice; selecting the optimal lens for a specific task is difficult, often exacerbated by complex and apparently conflicting specifications. Below we will discuss the basic lens choices and make recommendations for those wishing to make a start in this discipline.

Choosing a contact lens
In choosing a contact lens, the three key aspects to consider are the region of the globe to be studied, the required magnification, and the field of view. Table 1 presents the major lens types that an optometrist may wish to consider.

For imaging, the first decision to make is whether the emphasis is on the anterior chamber angle, the central retina or the peripheral retina. Figure 1 show the sections of the eye to target.

There are two main “general purpose” lenses: the four-mirror lens (Figure 2) and the three-mirror lens (Figure 3). Either of these would be an ideal first lens, with the choice between the two dependent on the individual practitioner’s interests and access to alternative imaging equipment.

The four-mirror lens allows for a speedy evaluation of all four quadrants of the anterior chamber. Both static and dynamic gonioscopy can be performed. In addition, the central optic provides a 30-degree view of the posterior pole, allowing for examination of the macula and optic nerve. By focusing in front of the retina it is also possible to scan the vitreous, although the field of view is limited. Hence, this lens covers areas 1-3 in Figure 1. It has the added benefit of not requiring contact fluid because the contact endpoint is small and has a similar curve to the cornea; the patient’s tears are therefore sufficient as the coupling solution.

The three-mirror lens is the alternative device to consider if just a single contact lens is to be selected for a practice. It is a great lens to visualize all main regions of the eye because it has four viewing optics—three mirrors plus a central optic. This allows for imaging of the anterior chamber, the poste-
rior pole (central 30 degrees), the vitreous, the mid periphery including the arcades, and the far periphery (labeled 1-5 in Figure 1). In order to see around the whole globe, rotation of the lens is necessary. Some lens designs do not require contact fluid; however, better imaging is achieved if fluid is used because the contact endpoint is larger than a four-mirror and typically the curve does not match the corneal curvature. Not only is this an ideal first (or second after the four-mirror) lens to have in practice, but the techniques learned are applicable to all other types of lenses. With all contact lenses, a firm but light touch will ensure good contact without putting undue pressure on the cornea. The patient may not complain, but with too much pressure, the cornea can be affected and wrinkling of Descemet’s membrane can occur.

Pupil dilation is usually required when using a three-mirror lens. The “direct” viewing nature of its design means that the pupil of the eye is the limiting aperture. Central viewing may be reasonable without dilation, but imaging the peripheral retina would be challenging. If the practitioner needs to view the retina without dilation, or the patient does not dilate well, then an “indirect” contact lens design would be better because the pupil is not the limiting aperture. This is due to the fact that for indirect lenses, the narrowest part of the ray bundle is at the nodal point of the eye, making it more efficient for light in (illumination) and light out (image formation). The retina lenses described next are indirect lenses, and while they perform optimally with a diluted pupil, in situations in which nondilated eye examination is necessary, they provide the best images.

If the practitioner wishes to proceed further with contact lenses, the next to acquire would be a lens for viewing the retina. The Fundus lens provides a good image of the posterior pole, particularly the macula and optic nerve head out to about 36 degrees and the vitreous (regions 2 and 3 in Figure 1). The Retina 90 lens gives a wider field of view out to the arcades but is still concentrated on the central posterior pole (regions 2, 3, and part of 4 in Figure 1). This provides detailed examination of the optic nerve and macula while also allowing inspection of a broader area.

For a very wide field of view that includes the peripheral retina, various lenses such as the Retina 170 and Retina 180 are available (areas 2-6). They offer a good overall examination, which is ideal for patients with diabetes and other potential peripheral retinal problems. With a little manipulation of the device, it is easy to observe out to the periphery.
Lenses for imaging

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Single-use vs. reusable lenses

Single-use or disposable lenses are a relatively new concept, and they offer many benefits. The most obvious benefit is that the sterile, single use format (Figure 4) removes all responsibility (from the doctor, clinic and/or hospital) for cleaning and disinfection of the lens, and alleviates concerns about disease transmission. Some clinics choose to have a box of lenses on hand for use only with challenging patients.

Patients with a history of hepatitis, herpes, HIV, or readily contagious infection, such a red eye or a recent history of EKC-causing adenovirus, are good candidates for single-use lenses. Studies have shown that the adenovirus can remain alive on inanimate objects such as lenses or tonometers for up to one month. Furthermore the Centers for Disease Control (CDC) guidelines for disinfection and sterilization in healthcare facilities have recognized that 3% hydrogen peroxide and 70% isopropyl alcohol may not be effective against adenovirus. Disinfectants such as bleach in addition to the above are recommended; however, lenses may not be able to withstand bleach without affecting the lens quality. For those practitioners concerned with meeting Joint Commission standards, disposable lenses will assist with minimum effort and expense.

Single-use lenses are surprisingly cost efficient. Proper cleaning and disinfection of traditional reusable lenses, together with the upfront purchase costs, is expensive. Cleaning between each patient is an obstacle that few practitioners or practice managers had previously considered.
because until now there has been no alternative. The cost of chemical purchase and storage, utility use, and staff time add up. In order to avoid the upfront investment in traditional lenses, some practices start with disposable lenses only.

Another aspect to consider in a busy practice is convenience and patient flow, particularly in satellite clinics or practices with multiple lanes. There is no worry about losing a lens or having it stolen, dropping a lens, and no need to walk to a different room to find a lens.

Many private clinics choose single-use lenses as a practice builder. The doctor can explain to patients that single use, sterile lenses offer first-rate imaging and the ultimate protection against disease transmission. This may differentiate the clinic from others in the area, it will reassure the patient that they are receiving the best care, and will demonstrate that the clinic is embracing the newest cutting edge technology.

One of the concerns raised about single-use lenses is quality. With modern manufacturing techniques, the quality and consistency is excellent, even with the high-volume production that allows the cost to be low. There is the added benefit of a pristine lens for every patient with no dust, scratches, or fingerprints, and no deterioration from multiple cleanings.

In summary, we are fortunate as eyecare professionals that, in contrast to other medical disciplines, we can view internal structures of the eye using relatively simple, low cost, non-invasive instrumentation. Contact lenses have stood the test of time and have served the eyecare professions well. While they are unlikely to be the only device in the optometrist’s toolkit, they may be a very useful addition to the practitioners’ repertoire.

REFERENCES