COMPARISON STUDY ON THE TRANSMITTANCE OF UV-BLOCKING ABILITIES OF CONTACT LENSES

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ABSTRACT

Background: Five commonly used soft contact lenses in our clinic were studied for UV-blocking characteristics. Two of the lenses are marketed for the UV-protective benefits. The purpose of the study was to compare the transmittance of UV in the recently released Acuvue Advance to other commonly used lenses. *Methods:* Five contact lenses were placed in a Beckman DU 640B Spectrophotometer to measure the UV transmittance. *Results:* Of the five lenses studied, the Acuvue lenses showed the most UV protection. *Conclusions:* UV protection is important for our patients and should be a consideration when fitting contact lenses.

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Introduction

With all of the recent published information on the damage that ultraviolet radiation (UVR) can cause, it is important for us as primary care providers to educate our patients on the need for UV protection and their options. The most common source of UVR is from the sun. UVR can cause both short-term and long-term effects. Ultraviolet C (UVC), 200-280nm, is primarily filtered out by the ozone in the earth's atmosphere and the damaging rays do not reach the ocular surface. Ultraviolet B (UVB), 280-320nm, is absorbed by the cornea, conjunctiva, and lens. The absorption of UVR by these tissues has been shown to cause photokeratitis, pterygium, pinguecula, cortical opacities, posterior sub-capsular changes and malignancies. These ocular complications lead to the categorization of UVB as being the most damaging of the three types of UVR. Ultraviolet A (UVA), 320-400, is absorbed by the lens, but also by the retina. Complications of absorption of UVA are less clear, but have been known to show retinal damage in laboratory animals. Age-related macular degeneration is believed to be attributed to UVR exposure; evidence has shown that UVR causes an intense shedding of photoreceptors resulting in retinal injury.

As primary eye care practitioners, we have the responsibility to inform patients of the damage that UVR can cause. Some common forms of UV protection include wide-brimmed hats, adequate coverage sunglasses, polycarbonate lenses for dress glasses, UV coatings, and UV filtered contact lenses. With the recent release of the Acuvue Advance, new recommendations on UV-blocking lenses present another option for patients. Our

study was designed to compare some of the more common lenses fit in our clinic at this time to aid in our recommendations.

Methods

The contact lenses used in this study are listed in Table 1, below. All lenses used were -3.00 D, which is the thinnest lens in the Acuvue line. We chose this power because the thinner the lens, the less UV blocking ability the lens has. We started this study using a wet cell to more closely simulate an ocular environment; however, we found the wet cell provided more UV protection than some of the contact lenses evaluated. We therefore evaluated a dry lens, which was first rinsed in saline and then patted dry with lint free Kimwipes. Each lens was aligned in a toric contact lens holder with the backlight blocked off to prevent light dispersion. After calibration, the lens holder with each contact was placed in a Beckman DU 640B Spectrophotometer.

Table 1: Soft lenses evaluated

Brand	UV-Blocking	Water Content	Material	Power	Base Curve	C.T.
Focus 1-2 Week	No	55%	vifilcon A	-3.00	8.4	0.060
Optima FW	No	38%	polymacon	-3.00	8.4	0.080
Acuvue	Yes	58%	etafilcon A	-3.00	8.4	0.035
Focus Night & Day	No	24%	lotrafilcon A	-3.00	8.4	0.070
Acuvue Advance	Yes	47%	galyfilcon A	-3.00	8.3	0.070

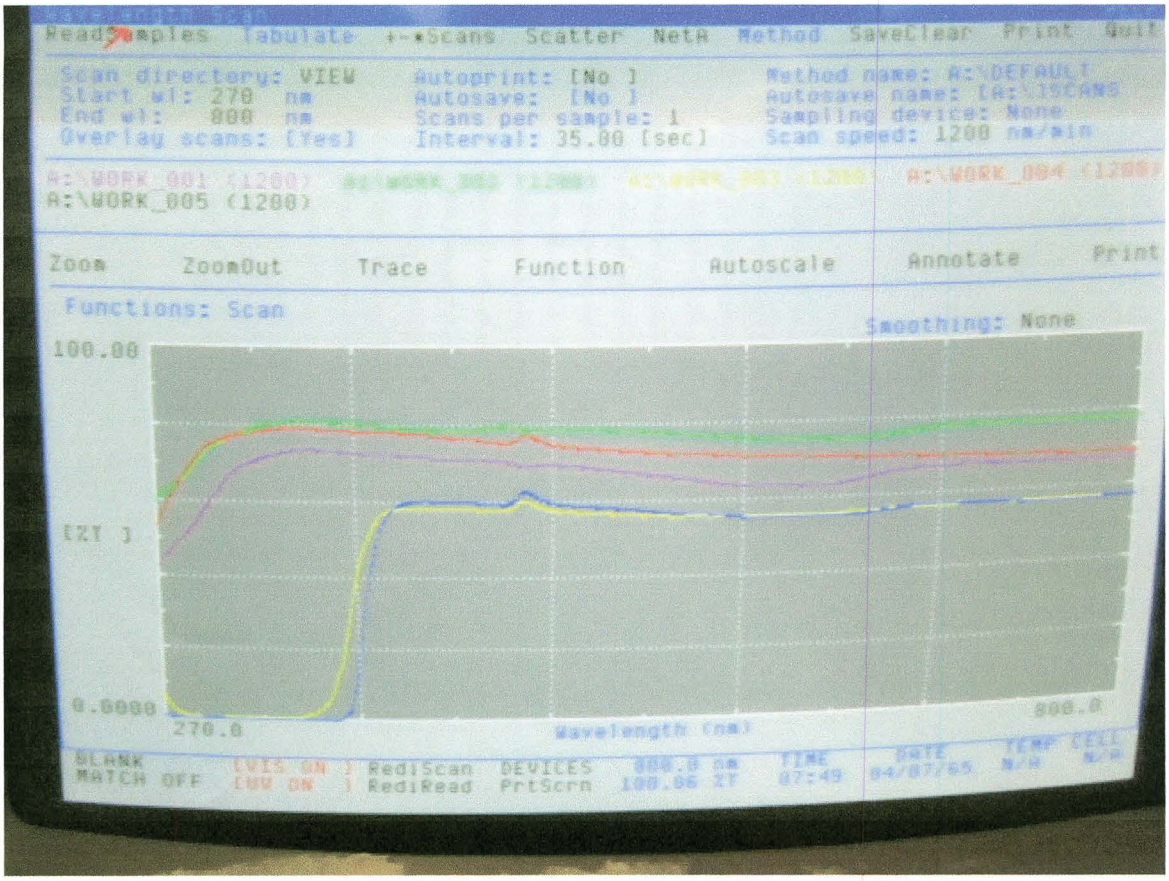
Results

The results are summarized in Table 2 and Figure 1. Table 2 shows the average percent transmittance for each of the contact lenses at set intervals in the electromagnetic spectrum. Figure 1 shows the overall transmittance of each lens from 270nm to 800nm. The colors of the lines in the graph correspond to the matching contact lenses named in Tables 1 and 2. All lenses showed a decrease in the transmittance of light through the visual spectrum. Both the Acuvue and the Acuvue Advance showed the best overall UV protection of the lenses tested. The Acuvue Advance has 0% transmittance from 318nm to 360 nm, while the Acuvue had 1-7% transmittance from 318nm to 360nm. The other lenses tested have significantly higher values ranging from 69-87%. However, these lenses are not marketed for their UV-blocking ability.

Table 2: Transmittance results for the lenses evaluated

Contact Lens	% Transmittance				
	UVC	UVB	UVA		Visual Spectrum
	271	318	360	380	555
Focus 1-2 Week	43	69	73	72	65
Optima FW	60	78	87	80	77
Acuvue	5	1	7	48	55
Focus Night & Day	54	78	79	78	72
Acuvue Advance	1	0	0	31	56

Figure 1: Wavelength Transmittance of Lenses Evaluated.



Discussion

Acuvue Advance has the best UV protection when compared to the other lenses in this study. The added component of benzotrizole to the lens material increases the UV-blocking abilities in the Acuvue line. The Acuvue lenses are the only lenses in this study with claims to UV protection. Our results demonstrated the difference between the Acuvue lenses and those lacking in their UV-blocking abilities. The benefits to having a contact lens with UV-blocking abilities are numerous. Soft contact lenses completely cover the cornea and limbal areas, which decreases tissue absorption of UV. This coverage decreases the amount of damage to the limbal epithelial stem cells, which are

important for corneal and conjunctival healing. The more complete coverage also decreases the amount of peripheral light focusing from the temporal limbus, which can lead to ocular pathology, such as a pterygium. The added coverage also helps in the prevention of cataracts, pinguecula, and corneal neoplasms.

In another study, Acuvue with UV-protection when compared to the Acuvue without UV-protection had similar comfort, clear vision and durability. The added UV polymer provided the protection needed without altering the quality of the lens. This has the advantage of opening doors for contact lens manufacturers to incorporate the polymer into future lenses. The Acuvue Advance, as well as Focus Night & Day, have the advantage of having a higher Dk/T, allowing more oxygen to the cornea. This benefit allows these contacts to be among the leading lenses recommended to our patients. The combination of increased UV protection as well as increase oxygen transmissibility in contact lenses without jeopardizing comfort and vision become great alternatives to some of the previously offered contact lenses.

In conclusion, we have found Acuvue Advance to be among the best contact lenses for UV-protection. However, any combination of sunglasses, polycarbonate lenses, UV-coatings, contact lenses, and wide brimmed hats can offer the maximum amount of protection for our eyes from UVR. When making recommendations for our patients, we need to consider all of their needs and educate them about what we can do beyond just their visual needs.

In the future, some of the newer hydrogel lenses, such as O_2 Optix and PureVision, should also be included. A few other non-mainstream lenses that claim UV protection may also be evaluated to compare to the Acuvue lenses.

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