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New York State Continuing Education Mail-In Course

Understanding Anti-Reflective Coatings

(Continuing Education from SEIKO)

NYSSO Course ID# 02-60

NYS CE Sponsor ID# 041998-042001.001

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We in the United States take pride in leading the world in advanced technology, and in many categories, that is the case. In one component of ophthalmic optics, however, the U.S. lags considerably behind many First World countries. Europe, for example, dispenses more than 60 percent of its eyewear with an AR coating. Canada enjoys a 30 percent market share for AR, and Japan currently has an astounding 90 percent AR usage. In the U.S., the AR Council recently reported the AR market had grown to 19 percent.

This seems a low number for such an advanced country, but a number of factors forecast that AR in the U.S. will increase rapidly during the next five years.

When light passes through a transparent medium such as spectacle lenses, a number of things happen.

In looking at a person wearing glasses (without AR), we see reflected light that is actually coming from both front and back lens surfaces of their lenses. That light is reflecting from the back surface and bounced back and forth between the front and back surfaces before escaping from both front and back surfaces. These internal reflections erode the image viewed by the wearer.

Ghost images are a common experience with glasses, particularly in driving at night. These visual annoyances appear as dull exact images created by reflections coming from the internal lens surfaces. With minus corrections, ghost images are crisp and reflected on the side of the light image TOWARD the optical center. With plus lenses, ghost images are larger, less distinct and appear away from the optical center. Most patients drive vehicles and understand the advantage of AR eliminating ghost images.

Reflections from back lens surfaces can also be annoying. This is most noticeable with sunlenses because the dark lens acts like a mirror. Backside reflections are also more prominent with aspheric lenses because their flatter

This course is worth one (1) New York State Ophthalmic Dispensing credit, which can be applied to Ophthalmic Dispensing licensing requirements.

inside surface reflects more light.

Strong minus lenses can produce a "coke bottle" look common to heavy minus lenses, caused by light reflecting from thick lens edges. The reflections appear as a series of concentric reflections or rings. Modern AR coatings virtually eliminate these unsightly rings.

Most advertising for AR features the cosmetic benefits of AR. While improving appearance is important, patients should also understand the visual benefits of AR coatings. Marketing people advise emphasizing the visual benefits of AR first. It will interest more consumers than only talking about the cosmetic benefits.

Current AR Technology

In previous years, eyecare professionals cited two reasons why they did not routinely offer AR: Time and quality.

Time. AR coatings ordered from local labs used to require two to four days additional processing time because labs had to ship lenses after processing to an outside AR coating facility. Many labs now have in-house coating equipment and AR coatings add one day or less.

Factory-coated stock lenses help. Edge an AR-coated stock lens and end up with AR-coated eyewear in an hour or less. AR stock lenses are supplied in a broad range, and the coatings are fine-tuned to the exact lens components, providing exceptional adhesion and long life. They can even be successfully drill mounted.

Quality. The quality of coatings has improved greatly in the past two years. Even so, there are still offices that don't suggest AR because of past problems with quality. This concern is no longer valid.

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Improved scratch coatings are making it possible for AR coatings to adhere more tightly and for longer periods of time. Improved hydrophobic top coatings make cleaning and maintenance of AR-coated lenses easier. Improved coatings and more sophisticated AR application equipment all influence the quality and durability of today's AR coatings.

The quality and performance of AR coatings has improved dramatically in recent years, so patients who refuse AR because of bad experiences in the past can be assured that AR technology has advanced tremendously in the past several years.

The Dynamics of AR Quality

Plastic lenses represent 95 percent of all sales in the U.S. Applying thin-film coatings to plastic requires laying an extremely fragile coating on a soft, porous, and temperature-sensitive substrate. It requires totally different procedures from applying AR on glass.

For maximum quality anti-reflective coatings, the coater needs to know the lens substrate, lens manufacturer brand, and type of scratch coating.

Identifying the lens material enables coaters to formulate their AR process to the substrate's index and chemical composition. Identifying the brand identifies which scratch coating is on the lens. For surfaced lenses, the coater wants to know what lab surfaced the lenses, which helps identify what scratch coating is on the backside of the lens. The resins used in a particular lens can also affect the adhesion of AR coatings. Lenses with resins that are more stable and less heat sensitive can better accept AR coatings and provide better coating durability.

Many plastic lenses come with a scratch coating applied by the manufacturer to at least the front surface. High index materials are softer than CR 39 and usually also have scratch coating on both sides. Some manufacturers also use a primer coat in addition to their scratch coat. If a flexible, shock-absorbing primer coat is used, this can greatly reduce crazing or peeling that can occur with AR coatings. Use of this primer coat technology did, for example, allow Seiko to introduce the first stock AR 1.0 center lens to the U.S. in the 1980s. Stock lenses have factory backside scratch coating, but lenses surfaced in a lab have backside scratch coating applied in the lab.

AR coating of high index lenses involves different issues. The best coating has the same index as the lens. A typical lab batch for AR may include high index lenses varying from 1.53 to 1.74. Many manufacturers, including Seiko and Hoya, have the ability to index match the coatings to the lens. A benefit of index matching is that it eliminates the "rainbow reflections" that can be seen on the surface of lenses that are not index matched. By getting rid of these reflections, the lenses seem to "disappear" into the frame.

Dispensing AR

There are three primary reasons for recommending AR coatings to eyewear consumers: (1) vision benefit; (2) cosmetic benefit; and (3) business benefit. The first two benefit the patient. The third benefits the eyecare professional.

1. The Visual Benefit (increased light transmission). People see better with AR-coated lenses. One reason is AR lenses transmit more light. Conventional glass or plastic gain 8 percent in light transmission (from 91 percent to 99.6 percent). High index lenses gain even more (11 percent to 16 percent, depending on the material). Increased light means wearers see things brighter and clearer, with crisper details.

2. The Cosmetic Benefit (eliminating reflections). Simply demonstrating the cosmetic advantage will convince the patient to order AR.

3. The Business Benefit. AR coatings have become popular in recent years. As a result, there is a growing perception among consumers that quality eyewear includes AR coating. Offices that do not routinely recommend AR risk having patients learn about it from a friend, neighbor or a competitor's advertising.

Identifying Candidates For AR Coatings

It has become routine in many offices to discuss AR coatings with every patient. Even when that is not office policy, there are specific times when recommending anti-reflective coatings is justified.

High Index Lenses. The higher the refractive index of the material, the less light is transmitted. Example: 1.80 glass transmits only 83.5 percent, but applying a modern AR coating increases light transmission to 99 percent or more. AR coatings increase light transmission to 99.5 percent with all high index materials. AR should always be recommended for high index lenses.

Aspheric Lenses. With flatter back curves, aspheric lenses produce increased annoying backside reflections. Aspherics are often made in higher index materials, so AR coatings should always be recommended when aspheric lenses are ordered.

Prescription Sunwear. Taking a clue from expensive name-brand sunglasses, many dispensers recommend backside AR for prescription sunlenses. Eliminating backside reflections from dark sunlenses produces a comforting improvement for wearers. Many offices now automatically include the cost for backside AR when quoting fees for sunglasses. Most coaters charge the same for backside AR coating as for two-sided AR coatings. Coating only one side of lenses requires interrupting the coating cycle and adds considerably to the time and cost factors of AR processing.

General Use Lenses. Consumers tend to associate AR coatings with quality eyewear, so many offices routinely recommend AR to every patient. Exceptions might be very young children, farmers, workers in environments hazardous to AR coatings (dust or airborne debris such as paint spatters), or those who work in situations where glasses would be subject to rough treatment.

Photochromics and AR. There have been many advances in photochromic technology and AR technology, and AR is now encouraged for modern plastic photochromic lenses. AR coatings also help when lenses are dark by reducing backside reflections from dark lenses.

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Explaining and Demonstrating AR

Explain AR's visual benefits first—patients see better with AR. AR-coated lenses transmit more light to the eyes. Explain how AR coatings increase light transmission by at least 8 percent. With high index lenses or poly, the gain is even more (11 percent). Increased light transmission means things look brighter and clearer with crisper details.

After relating the visual benefits, explain the cosmetic advantages. Keep a pair of glasses at the dispensing counter with two plano lenses, one AR-coated and the other with no coating. The dispenser puts the glasses on and, pointing to each lens in turn, asks, "Would you prefer your lenses with glare or no glare?"

AR requires "show and tell" demonstration tools. Many AR coaters and lens manufacturers provide effective kits that demonstrate the cosmetic benefits of AR coatings. In using these kits, be sure to spend equal time explaining the visual benefits of AR. The most effective way to emphasize the visual benefits is to have the doctor recommend AR during the examination.

Some patients hear stories about the difficulties of keeping AR coated lenses clean. When random fingerprints or oil smudges appear on uncoated lenses, they are seldom noticed because surface reflections conceal them. The totally reflection-free surface of an AR coated lens lets fingerprints, oily smudges, or dust particles stand out on the clear lens surface.

Modern technology has an answer to this minor problem. The top surface of a multi-layer AR coating is quartz, a form of glass that has a "hydrophilic" (water loving) property, permitting oily finger smudges and other debris to "cling" to the lens surface. Modern AR coaters now add a top hydrophobic (water-hating) layer. It repels oils (fingerprints) and makes the lens anti-static, so dust is easily removed with a tissue or cleaning cloth. Discuss this with patients.

Dispensing Tips

Don't send out half pairs for coating. When only one lens is required, most labs will strip AR coating from the old lens and re-coat both lenses together for an exact color match. Never use a stock AR lens for one eye and order custom AR coating for the other. Inevitably, there will be a slight color difference in the AR coating. The difference in color has no effect on vision but is always noticed by the patient.

Tinting. Stock AR lenses are non-tintable because the dye cannot pass through the AR layer in a hot water bath. The hot water would also damage the AR coat. Therefore, if a patient requests a lens to be both tinted and AR coated, the tinting must be done first.

Tint lenses 10 percent to 15 percent darker than the desired color. Bleach them back so lenses are about 5 percent darker than the desired final shade. This removes surface dye so the AR cleaning process won't reduce color more than what the patient wants. When tinting, do not mix a stock lens with a surfaced lens.

Cleaning. Be sure to explain to the patient that AR lenses must never be cleaned dry, as this can scratch the coating. The best cleaner is one that is made especially for AR-coated lenses. Patients should not use Windex, acetone, caustic solutions, or soaps (which leave deposits on the lens surface).

Imparting all this information to patients is important because everyone wants to look good in new eyewear. They also want what brought them in for an eye examination in the first place—the best possible vision. AR-coated lenses answer both basic needs.

Make sure that every eyewear patient going through the office gets an explanation and demonstration of anti-reflective coatings's benefits. This ensures that every patient understands you are trained and skilled in dispensing what has become accepted as the most advanced modern eyewear available.

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Understanding Anti-Reflective Coatings

Circle the best answer for each question and return to:
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1. According to the AR Council, AR usage in the U.S. is currently:
 - a) 60%
 - b) 30%
 - c) 19%
 - d) 25%
2. People wearing non-AR coated glasses when driving at night often experience:
 - a) Double images
 - b) Ghost images
 - c) Distorted images
 - d) Blurred images
3. In custom coating, the AR coater needs to know:
 - a) The lens substrate
 - b) The lens brand
 - c) The type of scratch coating on the lens
 - d) All of the above
4. Scratch coating on high index lenses is usually on:
 - a) Front surface only
 - b) Back surface only
 - c) Both front and back surfaces
 - d) High index lenses seldom have scratch coating
5. The visual benefit that comes from increasing light transmission with AR coatings is:
 - a) Wearers can read smaller print
 - b) Wearers see everything brighter and clearer with crisper details
 - c) Their lenses have no reflections
 - d) Viewers can see their eyes better
6. Which of the following UNCOATED lenses will transmit the least light:
 - a) CR-39
 - b) Polycarbonate
 - c) High index 1.60
 - d) High index 1.66
7. What is the primary reason AR coatings are usually recommended for aspheric lenses:
 - a) Some aspheric lenses are made in high index
 - b) Aspheric lenses are more expensive
 - c) Aspheric patients are more vain
 - d) Aspheric flatter back curves reflect more light into the wearer's eyes
8. Why is backside AR recommended for sun lenses:
 - a) People see better in dim light
 - b) Dark lenses increase backside reflections
 - c) People see better in bright light
 - d) There is no advantage to backside AR for sun lenses
9. Which of the following statements is true:
 - a) AR should never be used with photochromic lenses
 - b) AR should only be used with glass photochromic lenses
 - c) AR should only be used with plastic photochromic lenses
 - d) AR should be recommended for photochromic lenses
10. When should lenses that will be AR coated be tinted:
 - a) After the AR coating is applied
 - b) Before the AR coating is applied
 - c) It doesn't matter whether tinting is done before or after AR coating
 - d) Lenses to be AR coated should never be tinted
11. When presenting the benefits of AR to patients, what should you discuss first:
 - a) Visual benefits of AR
 - b) How to care for the lenses
 - c) Cosmetic benefits of AR
 - d) The cost of AR
12. What is a primary business benefit provided by AR coatings:
 - a) Satisfied patients will recommend AR to others
 - b) Consumers expect quality eyewear to include an AR coating
 - c) Profits are greater when AR coatings are dispensed
 - d) All of the above
13. When might it be inappropriate to recommend AR coatings:
 - a) When the patient works in a dusty or dirty environment
 - b) When the patient is elderly
 - c) When patients look like they can't afford the extra cost
 - d) When the patient is ordering more than one pair of glasses
14. Which of the following statements is NOT true:
 - a) A multi-layer AR coating is extremely thin
 - b) The top layer of modern AR-coated lenses is hydrophilic
 - c) Modern AR coatings have at least 5 or more layers of AR
 - d) An AR-coated 1.66 lens transmits the same amount of light as an AR-coated 1.60 lens
15. What is the best way to clean AR-coated lenses:
 - a) Soap and water
 - b) Windex
 - c) Cleaning solution provided by the coater
 - d) Any of the above

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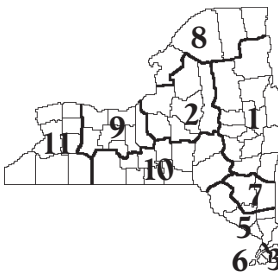
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