What I Look for in IOL Material

The advantages and pitfalls of acrylic and silicone lenses.

BY JOHN R. WITTPENN JR, MD

There are two primary lens materials from which a modern IOL can be manufactured: silicone and acrylic. Many surgeons implanted silicone-based lenses during the beginning of IOL implantation because it was flexible and easy to insert through a small incision. Recently, there has been an evolution from silicone- to acrylic-based lenses now that acrylic lenses have become more malleable. Following are factors I consider when deciding on IOL material.

PRIMARY LENS MATERIAL

Silicone-Based Materials

The problem with silicone lenses is they do not adhere to the capsular bag. Years after a silicone lens has been implanted, the haptics may have become fibrosed or surrounded by capsular fibrosis, but the optic itself may still be very easily moved across the capsular bag. As a result, silicone lenses can be pushed from one spot to another. Silicone-based lenses are generally three-piece IOLs with polypropylene haptics. These haptics lose all rigidity very quickly once implanted in the eye. Consequently, they do not hold the lens in position. Capsular contraction or fibrosis can easily push the lens off center even months or years after surgery. Therefore, I have moved away from implanting silicone-based IOLs as my first choice of lens.

Acrylic-Based Materials

There are two different types of acrylic lenses: hydrophobic and hydrophilic. Hydrophobic acrylic material repels water, and it has been the predominant acrylic material for the past several years. Hydrophilic materials can be problematic, because they are more prone to extensive glistenings or even deposits that compromise optical clarity. The benefits of hydrophilic material are increased flexibility and the ability to be inserted through very small incisions. The benefit of hydrophobic acrylic materials is they do not absorb water. As a result, this material has significantly fewer problems with deposits and opacification.

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WHAT TO LOOK FOR IN MATERIALS

Optical Clarity

The first quality I consider is whether the material maintains its optical clarity. The loss of optical clarity is an issue with some hydrophobic acrylic lenses, due to glistenings, whic are caused by hydrophilic impurities in the hydrophobic material. These impurities tend to accumulate wherever water is trapped in the hydrophobic material. The concentration of the hydrophilic impurities creates an osmotic gradient with the fluid surrounding the lens, which causes the movement of more water into the space. The resulting glistening or vacuole in the lens will continue to grow in size until the osmotic pressure equalizes with the tensile strength of the material. Hydrophobic lenses with increased amounts of hydrophilic contaminants that have a low tensile strength will be very prone to glistening formation. The impact of glistenings on visual function remains a subject of debate. It is not clear if it is clinically significant. However, if glistenings can be avoided by choosing a different material, it seems logical to do so.

All hydrophobic materials have some degree of hydrophilic contamination due to the nature of the phase separation processes used to produce the material. However, manufacturing techniques can have a significant impact on the degree of contamination, making certain lenses more susceptible to glistening formation.

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Additionally, temperature changes allow water to collect within gaps formed by nonhomogenous polymerization. Injection-molded versus lathe-cut material may also cause more gap formation with an increased potential for glistening formation. Glistenings develop to some degree in all hydrophobic acrylic IOLs but appear to be most prevalent in the AcrySof (Alcon Laboratories, Inc., Fort Worth, TX) group of IOLs.

Aberrations

I also like lenses that have low chromatic aberrations, which measures the difference in refractive index of the material for different wavelengths of visible light. The refractive index is dependent on wavelength. A desirable material will refract all the wavelengths in the visible spectrum and, to the same degree, create a sharper focal point on the retina. Material with high chromatic aberration will focus short wavelengths (blue light) much more than long wavelengths (red light), resulting in greater defocusing of white light at the retinal plane. A measurement of the degree of chromatic aberration is called the *Abbe number*. The higher the Abbe number, the lower the chromatic aberration and the higher the retinal image quality.

CONCLUSION

I prefer the Tecnis 1-piece IOL (Abbott Medical Optics Inc., Santa Ana, CA), because its hydrophobic acrylic material has the lowest chromatic aberration and highest optical clarity of all of the hydrophobic acrylic lenses. Glistenings rarely develop in these lenses. Additionally, it has the highest Abbe number. Finally, its new injector system allows me to insert the lens through an incision of 2.2 mm with ease. ■

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