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ADVANCES IN OPHTHALMOLOGY AND OPTOMETRY

New Intraocular Lenses

Adam Jorgensen, MD[a], Charles H. Weber, MD[a,b,*]

[a]Department of Ophthalmology, John Moran Eye Center, University of Utah, 65 Mario Capecchi Drive, Salt Lake City, UT 84132, USA; [b]Eye Institute of Utah, 755 East 3900 South, Salt Lake City, UT 84107, USA

Keywords

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• Adjustable IOL • Clear lens extraction • Presbyopia

Key points

- Cataract surgery in the developed world is becoming more of a refractive procedure as patients look to gain or keep spectacle independence after cataract extraction and intraocular lens (IOL) implantation.
- Numerous IOL options with a wide variety of mechanisms are currently or soon will be available to help patients meet their postoperative refractive goals.
- Multifocal, extended depth of focus, trifocal, accommodating, and adjustable IOLs all have shown favorable results and have potential to gain widespread use.
- Decreased contrast sensitivity, glare, halos, and other photic phenomena continue to be limiting factors in most high-tech IOLs.
- Careful patient selection is paramount to achieving successful outcomes with the latest in IOL technology.

INTRODUCTION

Since the advent of IOL placement after cataract extraction, a constant evolution of IOL design, material, and function has taken place. Concurrently, patient expectations have evolved such that cataract extraction with IOL placement is now often seen as more than a vision-restoring surgery and also as a refractive procedure giving an opportunity to reduce or eliminate spectacle dependence.

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*Corresponding author. 755 East 3900 South, Salt Lake City, UT 84107. *E-mail address:* cweber@theeyeinstitute.com

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As patients become more specific with postoperative goals, the challenge of meeting their goals mounts, with an increasing number of patients with prior refractive surgery now presenting with symptomatic cataracts and hoping to maintain their current spectacle independence. The fact that incorrect IOL power is still a leading cause of IOL explant and exchange [1] underscores the persisting limitation in biometry and IOL power calculation methods. It also demonstrates the difficulty surgeons still face in consistently meeting patient demands.

Such a climate has paved the way for numerous novel IOL designs over the past several years. Many of these offer multifocality or extended depth of focus, using refractive or diffractive lens optics. Others aim to recreate accommodation through a variety of techniques. Still others can have IOL power adjusted postoperatively using light, magnetics, a femtosecond laser, or other means. These astounding developments have shown promise and given a glimpse into the future of IOL technology. Finding a true replacement for the healthy crystalline lens, is one step closer.

This review covers several of the latest advancements in IOL technology and some of the newer available IOLs. It also covers several lenses that are not yet commercially available. Although it is not feasible to cover an exhaustive list of all technologies currently in development, hopefully readers will gain an appreciation for current efforts throughout the world to further the work of lens replacement and look to the future with excitement for breakthroughs yet to come.

EXTENDED DEPTH OF FOCUS AND TRIFOCAL INTRAOCULAR LENSES

The first Food and Drug Administration (FDA)-approved multifocal IOLs became available in the Unites States in 2005. As of 2013, 14% of IOLs implanted were premium lenses [2], indicating that despite any shortcomings, multifocal IOLs play a significant role in cataract surgery in the United States. Some of the latest models of multifocal and extended depth of focus lenses are discussed.

The Tecnis Symfony Extended Range of Vision IOL (Abbott Medical Optics, Santa Ana, CA) is a clear hydrophobic acrylic lens, which features a diffractive echelette design on the posterior optic surface that provides extended range of vision with reduced chromatic aberration and enhanced contrast sensitivity. In contrast to a multifocal lens, the Symfony has a single elongated focal point for extended depth of focus, which is theorized to reduce halos. It is available in both toric and nontoric versions. The Symfony gained FDA approval in July 2016.

Recent clinical trials have shown that the Symfony provides spectacle independence in greater than 90% of patients at distance and intermediate ranges with 74.5% spectacle independence at near. Greater than 90% of patients reported no or mild halos, glare, starbursts, or other photic phenomena. Mini-monovision targeting −0.50 diopters (D) in the nondominant eye increased spectacle independence at near [3]. A study comparing the Symfony with the Tecnis ZCB00 monofocal lens showed the Symfony outperformed ZCB00 in