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# Presbyopic Lenses: Evidence, Masquerade News, and Fake News

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Francis Bacon said "Science is measurement". In the recent development of presbyopic intraocular lenses (IOLs), a topic with an exciting historical development and today's ever-increasing passionate reality, measurement has become one of the key factors for their commercial evolution and clinical success.

Today there is a relevant interest in the new models of presbyopic IOLs. One of these are the so-called extended depth of field (EDOF) lenses. Emerging in recent years under such term, these lenses aim to provide the patient with the advantages of far-, intermediate- and near-vision performance without spectacles, and without the side effects of multifocality. EDOF lenses try to create a continuous change in focus from far and near without the overlapping of images that constitute both refractive and diffractive multifocality. In doing that, certain amounts of ocular aberrations are increased on purpose to create the minimal blur necessary to see different distances, even though with a "blur." EDOF lenses, in contrast to the recent development of modern monofocal IOLs in which the compensation of the aberrations of the eye targeted zero aberrations, the optics of the IOL are transformed with the induction of a certain amount, calculated in part, of aberrations with the benefit of near-vision performance. The resulting cost of this is quality of vision, which is degraded. No free lunch for near vision! How to measure this loss, how to measure the side effects and, especially how to measure the effectiveness to read at an adequate distance are the key factors to understand the effectiveness of these lenses and whether to choose them or not for our patients. Measurement of the performance at different distances seems to be intuitively easy, but it has not been performed in the recent development of most of these lenses, at least in a scientific and reliable way.

In a recent article, we highlight the need for standardization of the distance test, reading test and reading distance to compare presbyopic IOLs.[1] By choosing different charts at different distances, we can obtain different results with the same lenses, which explains the disparity for the same IOLs commonly found in the literature; different visual performances are published by different authors, very often masquerading bad outcomes. This issue has been particularly problematic with old models of the so-called accommodative lenses.[2]

Another totally different issue is how the perception of the patient is with this type of multifocal or EDOF vision. It is with the Rash test and its variations and visual function quality measurements that we can compare the perception of the patient regarding the visual quality that is obtained following the implantation of different presbyopic IOLs. The defocus curves and contrast sensitivity allow us to measure the actual effectiveness as the profile is different when different lenses are compared and the contrast sensitivity will tell us how much light and optical quality we sacrifice for the purpose. However, they should be performed using adequate standard operative procedures to test near and intermediate vision.[1]

When we started to study and practice multifocal IOLs in our patients,[3] we were astonished by the different performance and attitude of different doctors and the outcomes reported in different studies of the lenses. Some lenses, apparently good in the tabloid reports, were really fake news. This has happened with some EDOF lenses like the Wavefront IOL, which, in spite of the apparently good reported performance in meetings and tabloids, was withdrawn from the market because of the poor quality of vision perceived by the patients and never reflected in the studies published.[3] Pure EDOF lenses with a certain amount of aberrations to improve near vision may be difficult to be tolerated by the patient. Our brain is adapted up to a certain amount of aberrations over time, but a sudden increase may not be tolerated, even though we can improve vision at different distances. EDOF lenses are, by definition, lenses that provide a calculated decay in quality of vision that may be too much to provide adequate near-vision performance. This is why all EDOF lenses should be expected to provide bad quality of near vision, even though intermediate vision can be adequate. Glasses for near vision are expected with these lenses and it is anticipated that a significant number of patients will complain about the quality of vision. To claim using pure EDOF lenses to obtain near vision cannot be anything but fake news because this near-vision performance is not feasible with an adequate tolerance of the quality of vision perceived by the patient.

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The problem we have today on the market is not only about fake news, but also about masquerade news comments. We qualify this as commercially biased information which tries to obtain our favorable opinion about some lenses because they look different or they provide a different type of performance. Some of the so-called EDOF lenses available today are actually multifocal lenses with low power in which part of the rest of the power has been withdrawn to avoid the overlapping of images and the consequent halos and glare, by a certain standard of focus caused by the induction of spherical aberration to a certain level. The effect of EDOF on these lenses is mainly because of multifocality and not to the EDOF effect. Some concepts are wrongly used. For instance, achromatization does not bring an EDOF improvement but rather an improvement in the contrast sensitivity function. Multifocality, either refractive or diffractive, is not EDOF. The added value of the spherical aberration included will always influence near vision performance by $<1$ diopter but the EDOF effect will only work if the lens is properly matched to the spherical aberration of the cornea of the patient, which is still not feasible today.

In this special issue, the reader will find 2 interesting articles. In the first, Sudhir et al[4] offer an analysis of the literature on the performance of the AcrySof IQ PanOptix vs trifocal IOLs (FineVision Micro F a multifocal lens with EDOF effect and achromatization, the Tecnis Symfony ZXR00, which is a low-power multifocal lens with some EDOF).[4]

In their review, the authors find different performances reported by different authors, which is explained by the reading test techniques.[1] It is noteworthy that in the studies quoted by the authors,[5,6] up to 25% of the patients need near-vision glasses,[5] something that is expected as the decrease in IOL power is not always compensated by the EDOF, creating an insufficient amount of light for reading purposes.

In the other article, Nivean et al[7] report the outcomes of what they call a new generation of extended depth of focus IOL, which is actually a bifocal refractive lens with an EDOF profile. This lens, has a small central zone for near vision of $+3.5$ D, is obviously not a real EDOF lens but rather a bifocal lens which offers a peripheral asphericity to increase the effectiveness for near vision as a support for the optical power of the lens.

EDOF lenses should be called as such only when they do not have either refractive or diffractive added multifocality. Multifocal EDOF lens is a better term for the presbyopic IOLs that are compared in these studies. They are basically multifocals with some components of EDOF which on practical terms have low predictability as the spherical aberration of the lens is not matched with that of the cornea of the eye in which it is going to be implanted. It is indeed fake news that only EDOF lenses can restore multifocality with good quality of far vision and near vision at the same time because they are not compatible.

The clarification of this issue is important for the modern refractive and cataract surgeon to understand which lens to use and what to expect from them. Putting great value on honesty and clarity, the industry should not masquerade multifocality with EDOF to increase the commercial value of the new multifocal lenses.

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