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Mini Review

Optimization of Refractive Cataract Surgery

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Abstract

To achieve the best refractive result in cataract surgery, we need to be completely aware of possible concerns. It is a fact that there is not a single intraocular lens (IOL) that works for every patient. The primary motivator for the creation of premium Intraocular lenses is patients' desire for improved visual independence after surgery. Choosing the right Intraocular lens for each patient requires an in-depth familiarity with the many available multifocal and extended depth of field (EDOF) IOL, their optics, and their effects on visual quality. Patient-specific ocular features, such as the condition of the ocular surface, corneal astigmatism, spherical aberration, and other ocular comorbidities, must be assessed in a sophisticated and objective manner throughout the intraocular lens selection process. Last but not least, the surgeon takes into account subjective aspects such as ocular desires, lifestyle, temperament, employment, and interests when recommending an IOL.

Keywords: Refractive cataract surgery; Intraocular lenses; Customized cataract surgery

Abbreviations: ACD: Anterior Chamber Depth; AMD: Age-Related Macular Degeneration; ATR: Against the Rule of Astigmatism; DED: Dry Eye Disease; EDOF: Extended Depth of Field; IOL: Intraocular Lens; MIOLs: Multifocal Intraocular Lenses; PCO: Posterior Capsular Opacification; PCA: Posterior Corneal Astigmatism; SIA: Surgically Induced Astigmatism

Introduction

An increasing number of cataract patients seek spectacle-free vision with presbyopia-correcting IOLs in modern life's dependency on computers (intermediate vision) as much as near vision (40 cm and less) [1].

Accurate refractive correction and patient satisfaction with premium lenses are inextricably linked, as shown in several studies [2,3]. It is believed that the optical parameters of the intraocular lens implant determine the quality of vision; however, the need for reading glasses, the development of new health problems such as the dry eye [3,4], a decline in the lens's effectiveness [2], and the patient's emotional [5] may be attributable to patient satisfaction and long-term discontent among patients [2]. Furthermore, comparing the more affordable and/or emerging alternative lenses with the ones evaluated already is necessary [6-8].

Hence this study is designed to ascertain what we should consider in refractive cataract surgery through reviewing related

literature in search engines such as Google Scholar, Pubmed, and Elsevier. Paying attention to the following algorithm (Figure 1) concerning the essential needs of each patient (reading the newspaper, working with the computer, driving during the day, driving at night, driving in difficult situations, and climbing Stairs) will maximize the success of the surgeon and physician. Surgeons will benefit from this holistic paradigm because it will allow them to produce the best possible surgical outcomes and to live up to (and even surpass) patients' lofty expectations (Figure 1).

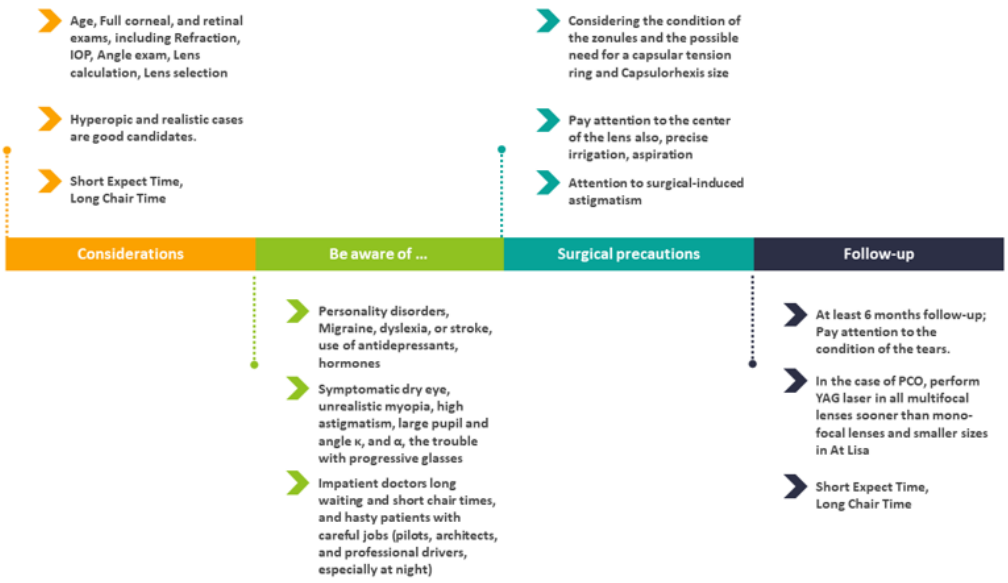

Figure 1: Considerations to maximize surgical outcomes of cataract surgery.

Long chair time and short waiting time throughout the entire preoperative and postoperative processes are the most important aspects to consider before surgery. We should consider the following issues well in advance of the procedure.

Analysis of Astigmatism and Lens Calculation

Final residual astigmatism, including anterior corneal astigmatism, surgically induced astigmatism (SIA), and posterior corneal astigmatism (PCA), should be as low as possible, preferably less than 1diopter [9]. In spite of the fact that one study found that clear corneal approach with IOL implant assisted by corneal topography could enhance visual acuity by reducing pre-existing astigmatism and creating lower corneal aberrations than typical temporal tunnel phacoemulsification [10]. In contrast, another study showed that with 1.5 mm and 2.2 mm incisions, there was no recordable difference in pre- and post-operative keratometric results [11]. Additionally, the study on phacoemulsification in patients with low to moderate corneal astigmatism found no difference between a clear corneal incision or an opposite clear corneal incision on a steep meridian during multifocal IOL implantation in terms of the change in total corneal higher-order aberrations [11].

Anyway, if there is a suspicion of significant posterior corneal astigmatism, in addition to corneal topography, tomography should be performed. Due to the aging-related increase in PCA and the increased likelihood of against the rule astigmatism (ATR) association with significant posterior astigmatism, the baseline value of astigmatism (-0.5) ATR should be lower than that for with the rule astigmatism (-1.25) in cases involving Multifocal intraocular lenses (MIOLs) implantation [12,13].

The Kane formula was found to be the most accurate when comparing new and updated ways of calculating IOL power (Kane, Hill-RBF 2.0, and Holladay 2 with new axial length adjustment) to the standard techniques (Barrett Universal II, Olsen, Haigis, Holladay 1, Hoffer Q, and SRK/T) [14].

Nevertheless, Combining the biometric parameters K, anterior chamber depth (ACD), and AL with the IOL power calculation formula selection approach may provide a more accurate postoperative refractive error measurement [15].

Aspheric IOLs can reduce or eliminate the positive spherical aberration added by conventional IOLs to the pseudophakic visual axis, affecting patient selection. LASIK, radial keratotomy, glaucoma, AMD, and epiretinal membrane require special IOL precautions. Hyperopia laser correction patients have enhanced negative spherical aberration and are best suited for aberration-free multifocal IOLs or IOLs with positive aberration. Some surgeons prescribe accommodating IOLs if multifocal and EDOF IOLs are intolerant of corneal coma [16]. Prior corneal surgical history, such as pterygium, is a significant cause of irregular astigmatism. In these circumstances, the IOL solution is comparable to keratoconus cases.

Centration

After multifocal IOL implantation, some patients complain of blurred vision and halos around the light, known as photic phenomena. Studies have shown that pupil size (A mesopic pupil measuring no more than 5 mm and a photopic pupil measuring no more than 3.5 mm, astigmatism, angle κ, and α should be considered in predicting the qualitative vision of patients after multifocal lens implantation [1,17-24].

A prior study revealed that the influence of moderate angle and distance (mean angle and distance range 0.10-0.62 and range 0.02-0.64, for each group, respectively, has no discernible impact on visual acuity following the implantation of a trifocal IOL [21]. For a kappa angle of more than 0.4, past research has shown that halo and glare become more noticeable. Vision quality declines as kappa increases over 0.5. However, the importance of the alpha angle outweighs that of the kappa angle [17,21-23] owing to four reasons: 1) stability of alpha angle from before to after surgery, 2) better prediction of IOL tilt concerning the visual axis, or alpha angle 3) The pupillary axis, also known as the kappa angle, does not refer to any ray that is traced via the optical system. It does, however, include the fixation point 4) Comparatively speaking to the natural aberration, the multifocal-induced aberration is more sensitive to the magnitude of the alpha angle [24,25].

Furthermore, different multifocal IOLs have different limits on the k value. ReSTOR (Alcon) is 0.4 mm, Tecnis multifocal IOL (Abbott Medical Optics) is 0.5 mm, and FineVision POD F IOL (PhysIOL) is 0.6 mm. For example, the optical diameter of the PanOptix lens is 1.164 mm, while it is 1.04 mm in the Lisa lens. This difference allows it to cover a kappa angle greater than 0.58 mm without disturbing vision [21].

Posterior capsular opacification (PCO) and dry eye disease (DED)

Depending on surgical technique, IOL design and material, and concomitant ocular diseases, PCO is the most common postoperative complication (rates of 11.4–43%) that occurs after cataract surgery [26,27]. The Yag laser should be used sooner in these patients than with monofocal lenses, and the size of the laser should be lower in Lisa lenses because of the smaller optics of the lens and the possibility of dislocation of the lens inside the vitreous.

Concerns that should be addressed before surgery include pterygium, Salzmann nodular degeneration, epithelial basement membrane dystrophy, the health of the ocular surface, and these conditions [16]. In agreement with other studies, they found that in patients with irregular corneal surfaces, the instillation of tears significantly improved surface regularity [28]. Changes in the tear film in dry eye patients can cause abnormalities on the corneal surfaces, resulting in glare impairment. However, in the early stages of dry eyes, these alterations may be too slight to be identified by corneal topography or contrast sensitivity measures [29]. Therefore, diagnosis and treatment of dry eye, particularly in the most irregular postsurgical corneas or severe dry eye, is necessary. It should be noted that the measurement of defocus in terms of 100% contrast and the difference in methods of measuring contrast might lead to an overestimation of reality and differences in study results.

Conclusion

According to modern human desires, it is necessary to look at cataract surgery as a refractive surgery to improve the quality of life. Various multifocal intraocular lenses presented satisfactory and efficient results. Differences in outcomes between groups in the review of studies should lead us to manage and plan for each patient (Customized surgery) according to her/his needs and individual characteristics.

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None

Conflict of Interests

The authors declare that they have no competing interests.

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