Moving Beyond Visual Acuity- Visual Quality and Stereoacuity

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Modern-day phacoemulsification is increasingly becoming akin to refractive surgical procedures, wherein a perfect visual outcome is expected in the postoperative period by the patient as well as the surgeon. To keep pace with increasing patient expectations, a wide range of premium multifocal IOLs are continually being developed with the aim of providing true spectacle independence at all distances. Conventionally, the success of the new IOLs are assessed in terms of visual acuity, with a 20/20 vision established as a benchmark parameter to evaluate the outcome of any lens.

However, the mounting evidence of 20/20 yet unhappy patients points towards the fallacy of using visual acuity as a sole outcome measure to assess IOL function. With more and more patients opting for multifocal IOLs, we also come across ever increasing reports of dissatisfied patients experiencing dysphotic symptoms and compromised visual quality.[1]

It is the need of the hour to shift our focus from visual acuity to more comprehensive parameters of visual function, encompassing visual acuity, quality and stereoacuity. We live in a three-dimensional (3-D) world, and with technological advancements 3-D is increasingly being integrated in the day to day life in the form of cinema, graphics, gaming as well as printers.[2] Conventional IOLs have focused on the correction of lower order aberrations only. However, in recent years, researchers are increasingly focusing on improving visual quality with better aspheric designs aimed towards reducing the higher order aberrations. Various aberrometers help to quantitatively assess the visual quality and higher visual function parameters, and these investigations help in a more comprehensive evaluation of visual function after implanting an IOL.

We have evaluated visual quality and stereoacuity after bilateral implantation of extended range of vision intraocular lens in patients undergoing phacoemulsification.[3] The extended range of vision (ERV) IOLs (TecnisSymfony, AMO) are the newer generation multifocal IOLs that aim to provide good visual acuity along all range of distances.[4] These IOLs do not result in the creation of two or three discrete foci as in conventional bifocal or trifocal IOLS; instead, they provide an elongated depth of focus and are associated with minimal dysphotic symptoms and optimal patient satisfaction. The IOL has an aspheric anterior surface to compensate for corneal spherical aberrations and an achromatic diffractive surface to correct chromatic aberrations. This results in an increase in retinal image quality without affecting the depth of focus.[5]

We observed a near stereoacuity of 30 seconds of arc or better in all our patients; of these, 80% cases had a perfect near stereopsis of 20 seconds of arc. Distance stereopsis of 100 seconds of arc or less was achieved by 82% cases, though fine distance stereopsis of 60 seconds of arc was achieved by only 36% cases.[3] The stereopsis correlated well with patient satisfaction and visual quality as assessed by ray tracing aberrometry, emphasizing the significance of a normal binocular interaction in assessing the quality of vision to ensure optimal patient satisfaction. There is a paucity of literature describing the normative values of stereopsis in older age group, though a worsening of stereoscopic threshold with age and in pseudophakia has been reported in few studies.[6] Our results of near stereoacuity after ERV IOL implantation were better as compared to previous studies with bilateral multifocal or monofocal IOL implantation.[7,8] This was the first study evaluating distance stereoacuity after bilateral multifocal implantation and further highlighted the need to integrate these parameters in routine postoperative evaluation.

Visual quality is conventionally assessed using aberrometry in terms of modulation transfer function (MTF), Strehl ratio and higher order aberrations (HOA). Modulation transfer function (MTF) is a measure of contrast and the Strehl ratio is a measure of the intensity of the image brightness, with an MTF and Strehl ratio of 1 signifying a perfect optical system. In recent years, aberrometry is being adopted as an additional investigative tool especially in postoperative assessment after multifocal IOL implantation. However, there is a lack of agreement regarding the specific cut-off values for these parameters and there exists wide variability between different aberrometer systems as well.[9] We observed good visual quality

as assessed by the ray tracing aberrometer and our results were in agreement with previous studies.[10,11] We considered 0.5 µm as the upper limit for coma, trefoil and spherical aberrations and all our cases had HOAs less than 0.5 µm.

There has been a quantum leap in IOL technology over the years and we have progressed from monofocal IOLs to bifocals, trifocals and now, ERV IOLs. In our clinical experience with ERV IOLs, we observed excellent visual acuity along all range of distances. Excellent near and distance binocular interaction was observed with ERV IOLs. Moreover, the stereoacuity correlated well with patient satisfaction and visual quality, highlighting the significance of normal binocular interaction in achieving optimal outcomes. Our study highlights the importance of routinely assessing binocular interaction with all IOLs, especially multifocal IOLs. Binocularity and depth perception are essential components of visual quality and may even act as markers for patient satisfaction. With improving technology, our focus should be to not only provide an optimal visual acuity across all range of distances but also an optimal visual quality with excellent binocularity.

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