

Abstract

The ocular wave aberration is strongly related with the visual quality having specific values for each eye. Its measurement and correction is challenging for fundamental research as well as for clinical practice.

In this work we develop an experimental apparatus to measure the ocular wavefront based on a Shack-Hartmann sensor with a high dynamic range. We use it for measuring monochromatic ocular aberration in two subject groups: a) normal young subjects (normal group hereafter) and b) penetrating queratoplasty eyes (pathologic group hereafter). The results show that mean RMS values of the high order aberrations in the pathologic group was ten times higher than that of the normal group. Further, there is a strong correlation between the corneal aberrations (obtained by corneal topography) and ocular aberrations in the pathological group.

We study the aberration correction using soft contact lenses, custom designed from each subject aberrations, by mean of both experiments and theoretical predictions. The study is carried out for three types of eyes: normal, keratoconus and penetrating queratoplasty. Results show that the main factors limiting this correction method are owing to both the mean position and rotation of the contact lenses on eye. We found that the normal subjects show a loss of optical quality relative to standard correction (sphere and cylinder), caused by expected displacements of the lenses contacts. In spite of the rotations and translations expected of contact lenses, there are, however, pathologic cases in which it is possible to reduce the RMS and increase visual quality, such as it was experimentally demonstrated in the keratoconus eyes.

