Whole In One: Visual Rehabilitation With A Specialty Contact lens Following Traumatic Iridodialysis

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Abstract:

A 52 year old white female with a history of open globe rupture, traumatic cataract, retinal detachment, 180 degree iridodialysis with angle recession and ocular hypertension of the left eye reported to the clinic with chief complaints of blurry vision, glare, photophobia, and longstanding mild frontal headaches, worse at the end of the day. The patient was fit with an Orion contact lens in the left eye. The patient reported significant improvement in visual comfort, glare, photophobia, reduced strain from squinting and improved cosmesis.

Background:

The human iris not only provides eye color but is critical to controlling visual input to the retina[1]. Sphincter and dilator iris muscles control pupil size, which accounts for 30 fold change in light transmission[1].

A traumatic event can compresses the eye, stretching the equatorial diameter of the globe, which can lead to the separation of iris root from the ciliary body resulting in iridodialysis[2].

Significant damage to the iris insertion reduces the eye's adaptive response to light[1]. This results in symptoms of photophobia, glare, reduced visual acuity, contrast sensitivity, and cosmesis [1,3].

As light moves through space, individual rays interfere with each other, at times constructively and at other times, destructively (see figures 1 and 2)[4].

When light passes through an aperture (e.g. a pupil) the image that is formed on a screen (retina) is mildly blurred a pattern known as an "airy disc" (see figure 3A) [4]. In order to resolve two objects as distinct, the peak (bright centers) of each airy disc must be at least as far as the trough (dark area) of it's neighbor (see figure 3 B and 3C) [4].

Additionally, inherent imperfections in an optical system cause entering light to focus at different distances resulting in a distorted image called an aberration (see figure 4). Aberrations increase with increasing pupil size[4].

The effects of diffraction and aberration increase with increasing pupil size (see figure 5) and compounded when multiple apertures are present. Taken together, the visual complaints patients with iridodialysis are multifactorial. The combination of polycoria and damage to the iris sphincter and dilator muscles render the patient unable to control the amount of light to the retina. This not only increases the risk of long-term damage to photosensitive cells, but induces distortion of the image due to aberration and diffraction.

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Conclusion :

An opaque iris-printed contact lens is a successful treatment for those patients for whom surgical iris repair is not an option. The artificial aperture reduces excess light transmission, eyestrain from squinting, glare, and photophobia while improving visual comfort and cosmesis

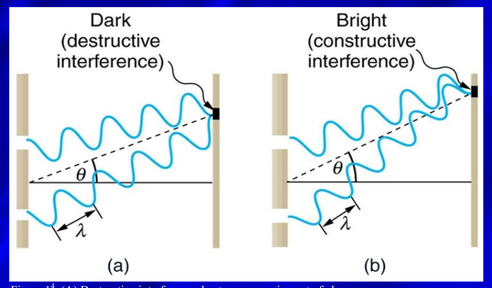

Figure 1[4]: (A) Destructive interference due to waves arrive out of phase
(B) Constructive interference due to waves arrive in phase

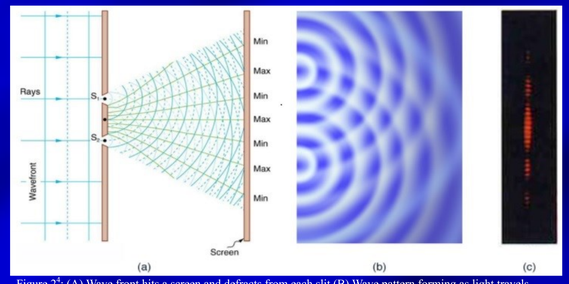

Figure 2[4]: (A) Wave front hits a screen and defracts from each slit (B) Wave pattern forming as light travels forward (C) Final image created from constructive and destructive interference

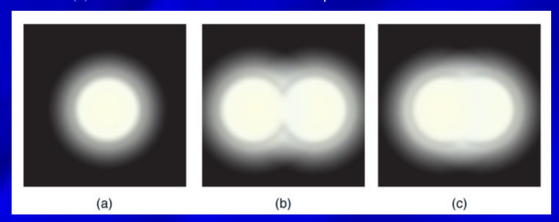

Figure 3[4]: (A) Diffraction pattern of monochromatic light (B) Two monochromatic point sources producing overlapping images that can be resolved and (C) Two monochromatic point sources producing overlapping images that can not be resolved

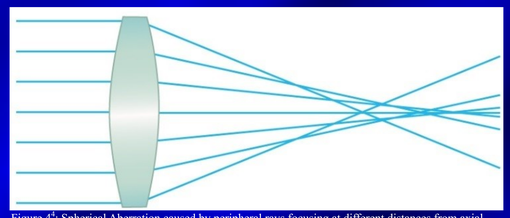

Figure 4[4]: Spherical Aberration caused by peripheral rays focusing at different distances from axial rays

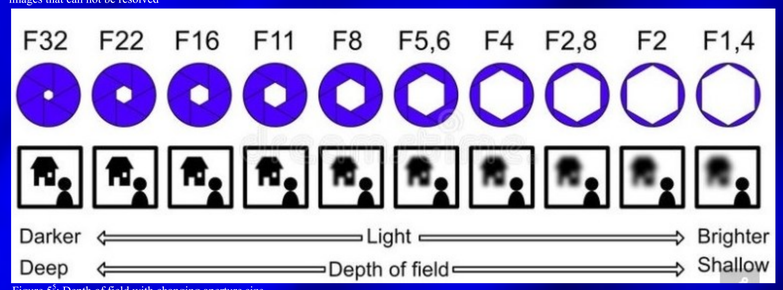

Figure 5[5]: Depth of field with changing aperture size

Case History:

A 52 year old white female with a history of penetrating open globe rupture, retinal detachment, pseudophakia and ocular hypertension presented to the clinic with chief complaints of blurred vision, glare, photophobia and longstanding frontal headaches, worse at the end of the day from persistent "squinting."
Medical history was otherwise unremarkable

Exam Findings:

Initial Visit:
Entering VAcc OD: $20/20^{-2}$ OS $20/25^{+2}$ (glasses)
SLE:
OD: Unremarkable
OS: Temporal corneal scar with mild corneal neovascularization 1.0-2.0mm at the scar area only. Irregular decentered pupil, iris atrophy, temporal elshnig pearl, mildly nasal- decentered intraocular lens

Contact lens evaluation:
The patient was fit with the following Orion Colored contact:
- -Underprint #3
- #52V Granite
- Starburst V
- 8.6/14.3/PL

Follow Up Visit :
Entering VAcc OD: $20/20^{-2}$ OS $20/20^{-1}$ (contact lens OS, with glasses overlay)
The patient noted significant improvement in he symptoms of visual comfort glare, photosensitivity, frontal headaches and cosmesis

Plan:
The patient was instructed to limit contact lens use to 10 hours per day. We recommended continued glasses wear over contact lenses for ocular protection and to return to the clinic in 6 months for follow up exam

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