RECENT SURGICAL ADVANCES IN TREATMENT OF APHAKIA

Essay Submitted for partial Fulfillment of master Degree In Ophthalmology

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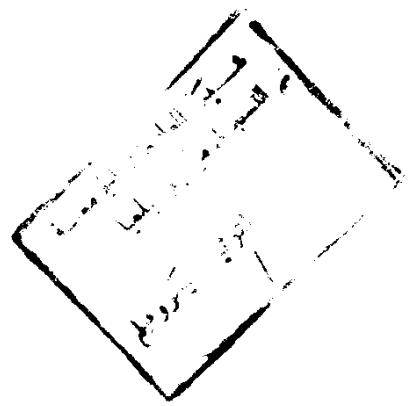

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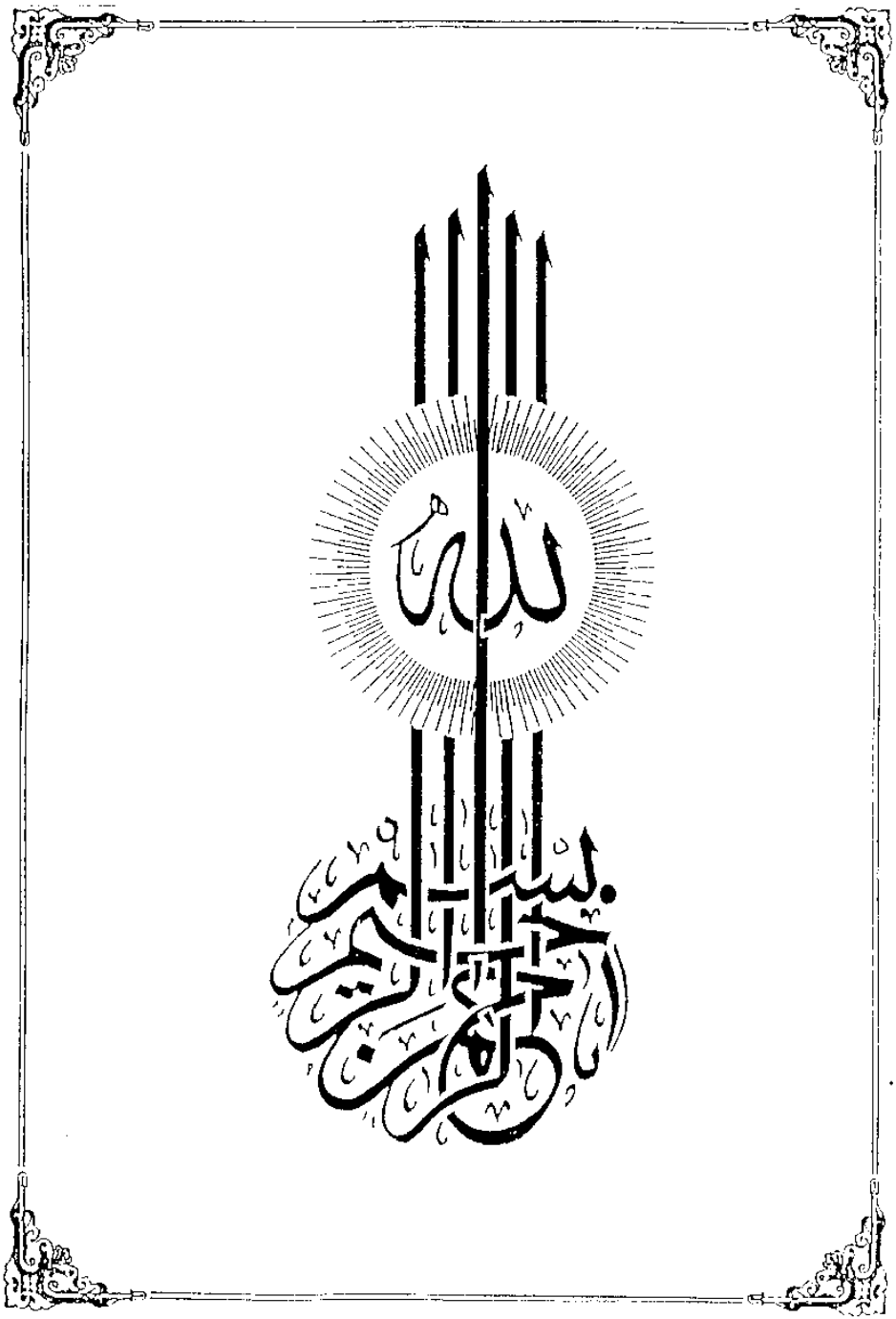

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INTRODUCTION

Aphakia and its correction

The aphakic eye is usually strongly hypermetropic. In the absence of the crystalline lens parallel rays of light are focused 21 mm behind the cornea, while the average anteroposterior diameter of the eye is 23 to 24 mm. The diopteric system must therefore be supplemented by a strong converging lens. The optical conditions are completely changed, as the diopteric system has been reduced to a single refracting surface: the cornea. The nodal point of the eye is thus moved forwards. The anterior principal focus for example is 23.22 mm in front of the cornea instead of 17.05 mm. (Duke-Elder, 1993).

Currently there are four acknowledged modalities for the correction of aphakia, each of which may offer successful visual outcome according to the patient's individual needs and expectations:

1. Spectacles.
2. Contact lenses.
3. Refractive surgery.
4. Secondary IOL implantation.

Visual rehabilitation with spectacle lenses:

Spectacle lenses were better accepted 30 years ago for two main reasons. First, it was the only method available for the

optical correction of aphakia. Second, cataract extraction was not usually performed till the stage of maturity. Thus, improvement of vision appeared dramatic to the patient and in turn his psychological adjustment to the difficulties of spectacles was easier (Dabezies, 1987).

The main disadvantages of spectacles are:

1. Magnification:

When an aphakic refractive error is corrected, the second principal plane moves forwards, so that a longer focal length is created, with a resultant increase in the size of retinal image. In spectacle corrected aphakia, the retinal image is magnified approximately 25% than when the eye is phakic. The visual acuity is theoritically worse than is indicated by the usual clinical tests. When vision is interpreted as visual angles, a vision 6/9 in a corrected aphakic eye corresponds to an acuity of only 6/12 in an eye with its optical system unaltered. The nearer the correcting lens is to the eye, the smaller will be the magnification. So in the contact lens the magnification of retinal image size is within 5%, while the IOL offers almost a normal optical situation (Duke-Elder, 1993).

Magnification causes objects in the surrounding environment to appear larger. The patient perceives such objects to be

closer than they really are. It is this phenomenon known as "spatial disorientation" that causes aphakic patients much discomfort, when first adjusting to their glasses. Distortion is also caused by magnification. This can be defined as a defect of image formation resulting in an image with a shape that does not correspond to the actual shape of the object. This results in the so called "pincushion effect". This effect is explained by peripheral magnification induced by a dual effect of increased refraction at the edge of the lens and the increased peripheral vertex distance (from the center of the cornea to the periphery of the lens) (Milder et al., 1984).

2. Prismatic effect:

The ring scotoma is an optically created zone of non visualization extending from about 50° to about 65° away from fixation when the eye is in primary gaze. As the eye rotates, fixation is brought closer to the optically blind zone. As a consequence, the object initially seen in the periphery, for example 45° from fixation, disappears into the blind zone when the eye turns to fixate that object. As the eye returns towards the primary gaze, it can see the object at 45° from fixation again. This phenomenon has been termed the "roving ring scotoma" or the "Jack in the box" phenomenon (Duke-Elder 1993).

3. Restricted visual field:

The other major cause of the complaint of poor side vision is that the visual field extending from the temporal 65° to the most peripheral portion of visual field at 85° is unrefracted, because light rays from this area are too peripheral to enter the spectacle lens. The resultant peripheral vision is very blurred.

In the past this was a major problem, however recently with the introduction of lenses of full field design, this has become a lesser problem (Dabezies, 1987).

4. Lens aberrations:

The peripheral portion of aphakic spectacles refracts incident light more than the center, and is also further from the eye. This combined effect causes overcorrection and blurring of the periphery of the visual field (Wenstrup et al., 1986).

5. Continual adjustment of aphakic spectacles: The aphakic patient uses only the optical center of the lens. Any maladjustment of the pupillary distance or the vertex distance produces large errors of refraction that reduces visual efficiency (Elkington, 1984).

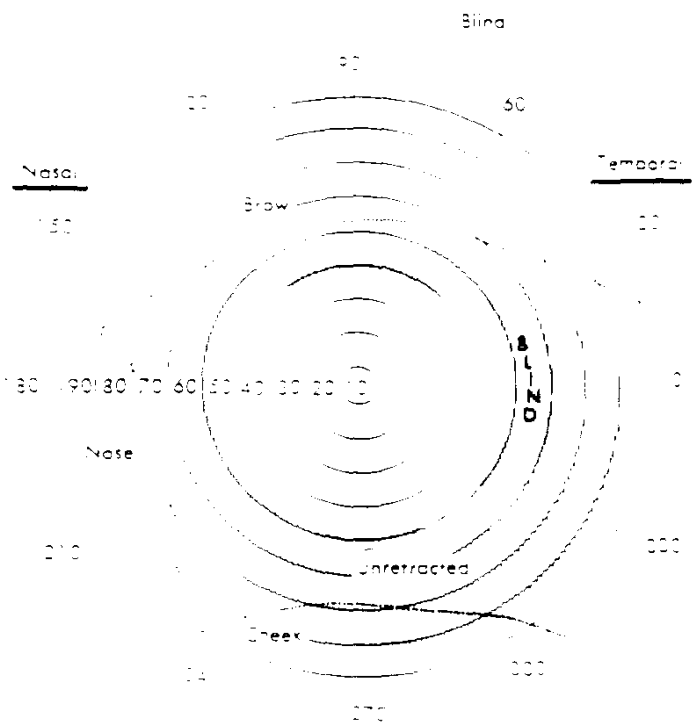

Fig. 1 Effect of aphakic spectacle lens on visual field

DISADVANTAGES OF APHAKIC SPECTACLES

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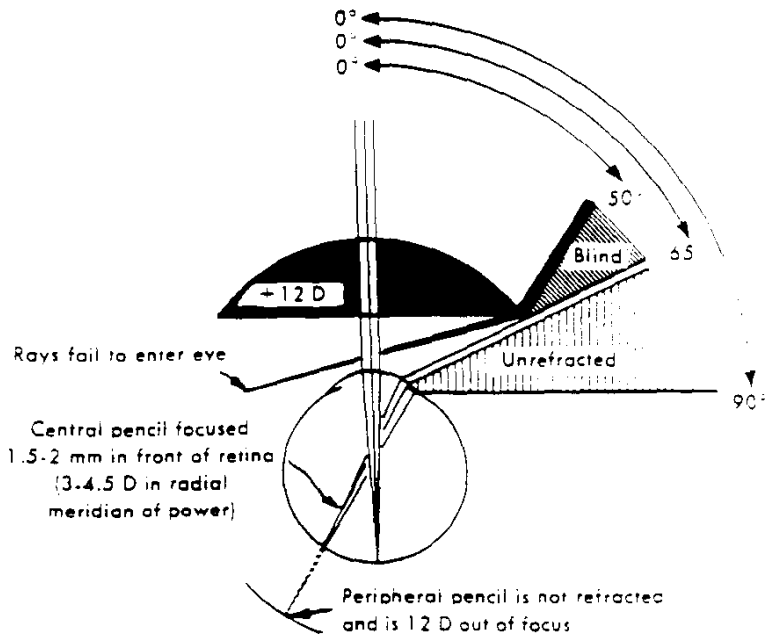
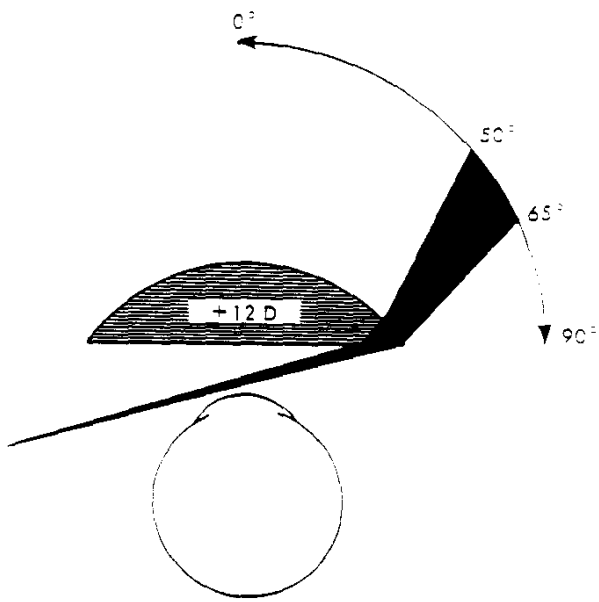


Fig. 2 Refraction of peripheral rays by high plus spectacle lens creates ring scotoma from 50° to 65° degrees.

Fig. 3 Peripheral prismatic effect of high-plus lens. Rays from 50° to 65° degrees fail to pass into the eye.



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DISADVANTAGES OF APHAKIC SPECTACLES

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6. Although spectacles are relatively inexpensive, easily changed and generally safe, they may be inappropriate, specially in infants, as they are larger, ugly and difficult to fit on small children with their relatively flat midface (Amaya et al., 1990).

Spectacles and unilateral aphakia:

It is obvious that spectacle correction has no place in the optical correction of unilateral aphakia. The retinal image being magnified 25% results in anisokonia and binocular diplopia. Visual input from the aphakic eye usually is suppressed, and in many cases exodeviation simulating microtropia is observed (Katsumi, et al., 1988).

Current types of spectacles for correction of aphakia:

There are two basic types: the lenticular design and the full field design. The prime advantage of the lenticular construction is the excellent optical surfaces minimizing the peripheral aberrations of the high plus lenses. On the other hand, the prime advantage of the full field design is the enlargement of the peripheral visual field provided by an underplussed peripheral design (Milder, 1984).