C.D

METHODS OF REDUCING THE INCIDENCE OF POSTERIOR CAPSULAR OPACITY AFTER EXTRACAPSULAR CATARACT EXTRACTION AND INTRAOCULAR LENS IMPLANTATION

ESSAY

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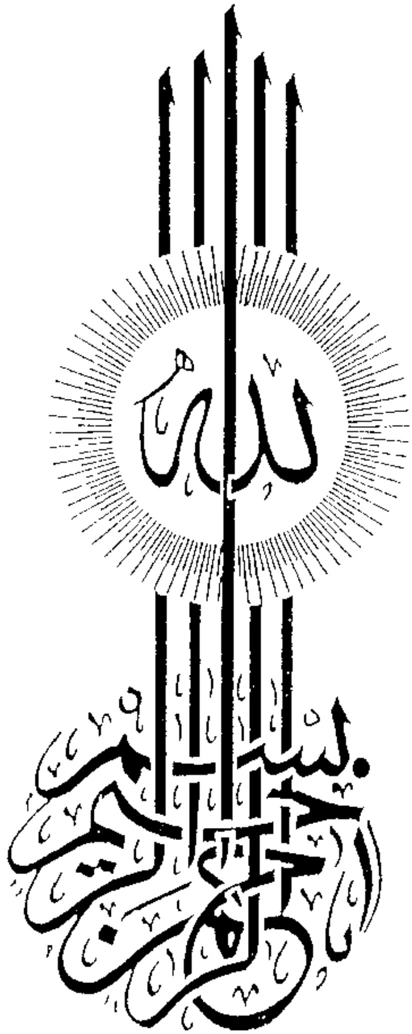
بسم الله الرحمن الرحيم

وقل اعملوا فسيرى الله عملكم ورسوله والمؤمنون

صدق الله العظيم


بسم الله الرحمن الرحيم

DEDICATED TO

My Father

For leading me into scientific and intellectual pursuits.
For the uncompromising principles that guided his life.

My Mother

For her magnificent devotion to her family.
For her unfailing encouragement.

اللجنة

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ABBREVIATIONS

ICCE	:	Intra-Capsular Cataract Extraction.
ECCE	:	Extra-Capsular Cataract Extraction.
PC	:	Posterior chamber.
IOL	:	Intra-Ocular Lens.
PMMA	:	Polymethylmethacrylate.
CCC	:	Continuous Curvilinear Capsulorhexis.
Perspex CQ™	:	A material disposed by Imperial Chemical
Invest. Ophthalmol. Vis. Sci	:	Investigative Ophthalmology & Visual Science.
P.C.O.	:	Posterior Capsule Opacification

INTRODUCTION

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With all the modern advances in science, among the most exciting and dramatic are those taking place in cataract surgery. Over the past 30 years, surgeons have perfected a technique for removing cataract within the capsule-inrtracapsular extraction. A survey at the Welsh cataract congress in 1980 revealed that 85 percent of the surgeons interviewed were performing intracapsular cataract surgery. The same survey repeated several years later showed that 70 percent of the surgeons were performing extra capsular cataract extraction. Cataract surgery is in a state of constant evolution [Abrahamson, 1986].

The introduction and use of contact lenses, eliminating thick spectacles, brought improved visual correction but was often accompanied by problems for the patient. Intraocular lenses were a dramatic advance in eliminating these difficulties and actually no one doubts that the quality of vision obtained with an intraocular lens implantation more closely resembles that of the phakic eye than the vision obtained by any other known method. However, because intraocular lens implant surgery is more complex than a routine cataract extraction, its history has been exciting, often frustrating, but finally rewarding. There have been abortive attempts at intraocular lens implantation dating back to the early eighteenth century [Clayman et al., 1983].

Nowadays, extracapsular cataract extraction and posterior chamber intraocular lens implantation are well-established procedures, with a greater than 95% success rate. Most surgeons agree that the ECCE procedure, regardless of the method of lens substance removal [planned manual or planned automated ECCE, phacoemulsification] decreases the incidence of several postoperative complications that were relatively frequent after intracapsular cataract extraction ICCE, particularly if the posterior capsule is left intact at surgery. Two significant long term complications that occur after ECCE and PC-IOL surgery include posterior capsule opacification [capsular fibrosis and epithelial pearls] and IOL decentration [Assia et al., 1991a].

Many investigators and surgeons made serious attempts to identify the factors that caused opacification following ECCE and implantation of earlier IOL types. One question that has always been puzzling is why a given surgeon who routinely uses a particular implantation technique and the same IOL design in all cases can have such widely varying results. Excellent results with no subsequent opacification are obtained in some patients, severe posterior capsule opacification PCO may occur inexplicably. This variation in results can best be explained by recognizing that the problem is multifactorial and related to many variables [Apple et al., 1992].

REVIEW OF LITERATURE

EMBRYOLOGY AND BASIC ANATOMY OF THE LENS

The human lens is the fundamental part of an extraordinary mechanism that for nearly half a century enables the eye to focus images on to the retina of objects distributed at a variety of distances throughout the visual scene. In order to perform this role it must be both transparent and elastic, the former to allow the passage of incident light and the latter to facilitate the repeated changes in shape accompanying accommodation. The lens is unique amongst organelles in that it consists solely of a single cell type, in various stages of cytodifferentiation, and retains within it all the cells formed during its lifetime [Marshall et al., 1982).

So, A well knowledge of lens embryology and anatomy is essential to study the lens function, growth, nutrition and diseases.

EMBRYOLOGIC DEVELOPMENT OF THE LENS

Origin: The lens is derived from a single primitive tissue, the surface ectoderm, after apposition and interaction of the anterior wall of the neuroectodermal optic vesicle with the epithelial lining of the embryo. Without this critical interaction, induction and therefore formation and development of the lens, does not occur.Such a failure causes a primary congenital aphakia [Marshall et al., 1982].

Morphologically, the development of the human lens passes though 4 stages :-

1 - Lens placode or plate	2 - Lens recess or pit
3 - Lens pouch or sac	4 - Lens vesicle

Figure (1) shows the development of human lens during fifth and seventh weeks of gestation.

The surface ectoderm covering the optic vesicle differentiates at about the 4 mm. stage in human embryos to form a slight thickening known as the lens plate or placode. The thickening is created by an elongation of the ectoderm cells, as well as by cell division. This thickening is believed to occur as a result of the action of induce substances produced by the adjacent neuroectoderm. The surface ectoderm cells of the lens plate are separated from those of the optic vesicle by a space which is bordered by the basement membranes of these two cellular layers. In the space between these two basement membranes the future primary vitreous develops. As a result of cellular growth and enlargement, the lens plate soon develops a small central depression, the lens pit. At about the 5 mm. stage the pit deepens progressively because of the cell growth along its wall, and at the same time the optic vesicle also invaginates to from the optic cup, permitting the developing lens to occupy part of its cavity [Spencer, 1985].

The primary vitreous forms in the cavity of the optic cup, between the lens and inner layer, a result of the invagination of the cup. The cavity of the lens pit widens to form the lens vesicle, the wall of which is composed of a layer of surface ectoderm cells. The vesicle is connected to the surface by the lens stalk, which disappears at the 9 mm. stage, leaving the lens vesicle within the

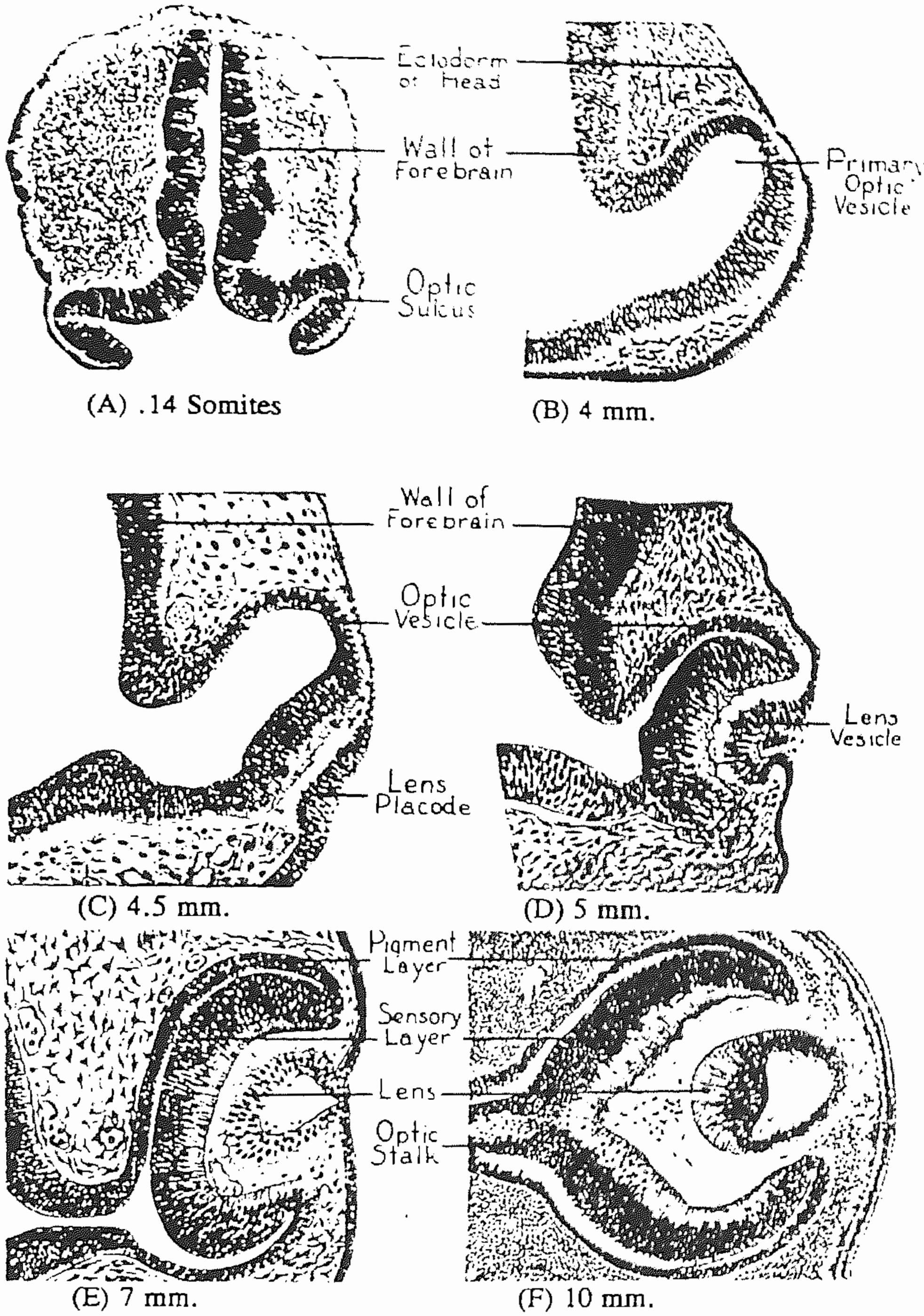

Fig.(1): Early stages in the development of the embryonic human lens, as shown in axial sections. (A) The first indication of the optic vesicles, even before the forebrain is a closed tube. (B) In the region of an optic vesicle the overlying ectodermal epithelium is beginning to thicken into a lens placode. (C) The lens placode is thicker and better delimited. (D) The placode is invaginating to form a lens pit and the optic vesicle is beginning to form an optic cup; periderm cells occupy the concavity of the unclosed lens vesicle. (E) The lens vesicle is a sac, about to detach from the ectoderm at the site of the lens pore. (F) The lens vesicle is free and closed; cells in its back wall are elongating into early primary lens fibers.
[Quoted From: Worgul, 1982].

eye. The surface layer of ectoderm cells of the lens differentiates to form a superficial layer of epitrichial cells that cast off into the cavity of the vesicle. The cells of the vesicles beneath the epitrichial layer are cuboidal in shape. These cuboidal cells of the lens vesicle form the definitive cells of the lens. During formation of the vesicle, the cells become inverted from their position in the surface ectoderm so that their apical surfaces face the cavity and their basal surfaces face outward against the lens capsule [Hogan et al.,1971].

The capsule is a continuous accruing basement membrane which is formed by the lens epithelial cells. The cells of the anterior portion of this vesicle, facing the surface ectoderm, remain undifferentiated throughout life, except near the lens equator, where they divide to form new lens cells. The lens epithelial cells facing the optic cup elongate to from the primary lens cells. These cells continue to elongate until they completely fill the cavity of the vesicle by the 16 mm. stage. The lens is almost spherical at this time, and remains so until about the 30 mm. stage. The lens itself, however, increases slowly in size [Worgul, 1982].

After this period the cells at the equator begin their life long job of forming secondary lens cells. Multiplication of cells occurs around the equator, and as this occurs, the most recently formed ones become elongated. As they do so, the anterior part of the cell extends forward beneath the lens capsule and the posterior part extends backwards. Each cell becomes U-shaped, with its nucleus near the equator. The anterior and posterior