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صدق الله العظيم

<u>Update of Accommodative Intra Ocular Lenses</u>

Essay

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By

Osama Youssef Amin Hassan

M.B., B.ch. Faculty of Medicine

Supervised By

Dr. Yehia Mahmoud Salaheldin Mostafa

Professor of Ophthalmology,

Faculty of Medicine, Cairo University

Dr. Rania Mohamed Sobhi

Ass. Professor of Ophthalmology,

Faculty of Medicine, Cairo University

Faculty of Medicine

Cairo University

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LIST OF ABBREVIATION

- AAIOL = Anterior Accommodating Intra Ocular Lens
- AIOL = Accommodating Intra Ocular Lens
- AC IOL = Accommodating Intra Ocular Lens
- ACCC= Anterior Continuous Curvilinear Capsulorrhexis
- ACO = Anterior Capsular Opacification
- AIOLs = Accommodating Intraocular Lenses
- AMO = Advanced Medical Optics
- BCVA = Best Corrected Visual Acuity
- BSCVA = Best Spectacle Corrected Visual Acuity
- CCC = Continuous Curvilinear Capsulorrhexis
- CLE = Clear Lens Extraction
- D = Diopter
- DCNVA = Distant Corrected Near Visual Acuity
- EAIOL = Elliptical Accommodating IOL
- EDTA= Ethylene Diamine Tetraacetic Acid
- FDA = Food and Drug administration
- Fig = Figure
- IOL = Intra Ocular Lens
- LECs = Lens Epithelial Cells
- MRI = Magnetic Resonance Imaging
- NDRA = Near Distance Refractive Addition
- Nd:YAG = Neodymium Yettrium-Garnate
- OVD = Ophthalmic Viscosurgical Device
- PCCC = posterior Continuous Curvilinear Capsulorrhexis
- PCIOL = Posterior Chamber Intra Ocular Lenses
- PCO = Posterior Capsular Opacification

- PMMA = Poly Methyle Meth Acrylate
- RA-IOLs = Real Accommodative Intra Ocular Lenses
- RLE = Refractive Lens Exchange
- UBM = Ultrasonic Biomicroscopy
- UV = Ultra Violet

Aim Of The Work

The aim of this work is to identify the accommodative IOL present currently as regards the types, the materials used & the designs; the advantages, the disadvantages & complications of each type.

INTRODUCTION

Although nowadays cataract can be treated with fairly satisfactory results, the patients lose the ability to accommodate in the classical way**,** **(Pusch J, 2004)** because the traditional pseudophakic intraocular lenses (IOLs) have provided excellent levels of uncorrected distance acuity, but have proved ineffective for near acuity. **(Dell S.J, 2005)**

The demands of modern society to improve the quality of life of people suffering from presbyopia make IOLs attractive compared to external aids. The long-term aim is the development of material for intraocular lenses, which not only allows the patients to recover their vision, but also enables them to accommodate without auxiliary aids. **(Pusch J, 2004)**

So, one of the most challenging tasks of modern cataract surgery is restoration of the accommodative ability in pseudophakic patients. Various attempts to solve the problem of loss of accommodation after cataract surgery have been made to enable satisfying distance and near vision without spectacles. **(Oliver Findl and Christina Leydolt, 2007)** Technological advances now provide us with the opportunity to afford our patients vision more similar to the pre-cataract state. **(Stachs O et al, 2005)**

The issue of restoring accommodation through refractive lens exchange (RLE) as for clear lens extraction (CLE) or following cataract surgery is becoming an increasingly important topic in ophthalmology, one that bears revisiting on a regular basis. Several different approaches can be taken using an IOL, one example is Multifocal IOLs that use different designs to provide distance and near vision following removal of the crystalline lens have been developed. **(Mamalis N, 2004)**

Multifocal intraocular lenses (IOL) that provide improved uncorrected near vision, but at the expense of reduced contrast sensitivity and disturbing optical phenomena. **(Leyland M. and Pringle E, 2006)** Also with using multifocal lenses a certain percentage of patients will report unwanted mesopic or scotopic symptoms, **(Doane JF. and Randolph T. Jackson, 2007)** such as decreased contrast sensitivity and glare and halos, **(Mamalis N, 2004)** and are subsequently dissatisfied with their operative endpoint. **(Doane JF. and Randolph T. Jackson, 2007)**

So problems associated with multifocal IOLs have stimulated research into the development of an accommodating IOL. Accommodating IOLs have the potential to provide near and distance vision without diminution of night time images and decreased contrast sensitivity. **(Mamalis N, 2004)**

At hence another alternative for the correction of presbyopia, a new generation of IOLs, so-called accommodating IOLs, have been developed. Provided the ciliary muscle maintains its potential for contraction with increasing age, the mechanism of these IOLs is based on the Helmholtz theory of accommodation, which hypothesizes force transmission from the ciliary muscle to the lens via the zonular apparatus, or Coleman's hydraulic suspension theory, which assumes that changes in vitreous pressure are responsible for lens shape changes. Currently available accommodating IOLs are designed to transform the forces of the ciliary muscle into a forward shift of the IOL optic, also referred to as the optic-shift concept. **(Oliver Findl and Christina Leydolt, 2007)**

A forward shift of a single IOL optic induces an increase in overall refractive power of the eye; a shift of approximately 0.60 mm would cause 1.0 diopter (D) of accommodation in the spectacle plane for an eye of normal dimensions. To attain accommodative amplitude of 3.0 D to enable reading at the customary distance of 33 cm (13 inch), an IOL movement of 1.8 mm is needed. **(Oliver Findl (A), 2005)**

As a result of several factors such as small pupil size, myopic astigmatism, corneal aberrations, corneal multifocality and good visual perception, pseudophakic patients may have an adequate depth of field to reach satisfying far and near visual acuity without any correction. This clinical phenomenon is referred to as apparent accommodation or pseudoaccommodation. It is also found in aphakic patients, proving that this phenomenon does not rely on the presence of an IOL. **(Oliver Findl (B), 2005).**

The amplitude of apparent accommodation is in the order of 1.0 to 2.0 D depending on which method of assessment is used. Therefore, if an accommodative IOL would cause at least 1.0 D of true pseudophakic accommodation by moving at least 0.6 mm, then most patients should be able to read without near spectacle addition. **(Oliver Findl (A), 2005)**

Common Types of Accommodative IOLs

The accommodative IOLs have different designs and materials, and have demonstrated accommodative ability, but the degree of accommodative amplitude has been reported to different extents and variabilities. **(Dick HB, 2005)**

Ring-Haptic IOL is the first accommodative IOL that was available on the market was the Ring-Haptic IOL designed by H. Payer and produced by Morcher GmbH in Stuttgart, Germany. Two designs were marketed in the 1990s, under the names BioComFold 43A and 43E, the latter with a few minor modifications in design. 1CU IOL is the second accommodative IOL that became available in 2001 is based on a concept