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Update of Accommodative Intra Ocular Lenses

Essay

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Table of Contents

Title	Page
• List of figure	I
• List of table	IV
• List of abbreviation	V
Introduction	1
Aim of the work	6
Review of literature	
▪ Anatomy of accommodative apparatus	7
The ciliary apparatus	7
The zonular fibers	9
The lens and capsule	11
▪ Physiology of accommodation	15
Definitions of presbyopia and accommodation	15
Factors affecting accommodation	15
Pseudophakic accommodation	16
Nomenclature (true & pseudophakic accommodation)	16
Physiology of Accommodation and Path physiology of Presbyopia	18
Theories of accommodation	19
• Helmholtz's theory	19
• Fincham's theory	22
• Schachar's theory	23
• Coleman's theory	26
Theories of presbyopia	26
▪ Types of accommodative IOLs	28
Single optic	
• BioComFold (Morcher GmbH)	29
• Human optic (Akkommodative 1CU)	31
• CrystaLens (Eyeonics)	38
• TetraFlex (Lenstec)	51

Dual optics	
• Synchrony (Visiogen)	58
• SarFarazi	64
Deformable optic lenses	
• The Medennium Smart IOL	68
• FlexOptic (Quest Vision) (AMO)	75
• LiquiLens (Vision Solutions Technologies)	77
• FluidVision IOL (PowerVision)	79
• NuLens (NuLens Ltd., Israel)	82
Lens refilling	92
Akkolens	105
Pixelated optic IOL	107
Summary & conclusion	108
References	112
Arabic summary	

List of Figures

Figure	Title	Page
Figure 1:	Anatomy of the ciliary body and ciliary muscle.	13
Figure 2:	The ciliary muscle groups and the suspensory ligaments.	14
Figure 3:	The suspensory (zonules) ligaments & the ciliary body processes.	14
Figure 4:	Helmholtz's theory of accommodation.	20
Figure 5:	Helmholtz's theory of accommodation.	20
Figure 6:	Schachar's theory of accommodation.	24
Figure 7:	Schachar's theory of accommodation.	24
Figure 8 A:	Reflection of a face in the centre of the air filled Mayler balloon.	24
B:	Reflection of a face in the periphery of the air filled Mayler balloon.	
Figure 9:	Schematic drawing showing the BioComFold model 43E (Morcher).	30
Figure 10:	The two semi-circular ring haptics of the BioComFold.	30
Figure 11:	Schematic drawing of the 1 CU accommodative IOL.	32
Figure 12:	Localization of the 1 CU accommodative IOL in the capsular bag.	33
Figure 13:	Transillumination photograph of 1 CU localized in the capsular bag 1 year after implantation.	37
Figure 14:	The CrystaLens accommodating IOL.	40
Figure 15:	Positions of CrystaLens at near and distance.	41
Figure 16:	Capsulotomy larger than optic and hinges in CrystaLens AT 50.	44
Figure 17:	Model AT-45 and (b) model AT-50.	47
Figure 18:	The Kellan TetraFlex KH-3500 IOL's haptics are designed to capitalize on the movement of the ciliary muscles.	51
Figure 19:	The TetraFlex IOL is based on an entirely different concept than other accommodative lenses.	52
Figure 20:A	UBM photograph of the TetraFlex IOL in the unaccommodated (distance) position.	53
:B	UBM photograph of the TetraFlex IOL in the accommodated (near) position.	

Figure 21:	Three-dimensional ray tracing portrays the refractive power across the pupil in an eye with the TetraFlex IOL.	54
Figure 22 A:	The TetraFlex lens in situ shows good centeration and orientation.	57
B:	The slit-lamp photograph shows the TetraFlex IOL in an eye.	
Figure 23 A:	5.5-mm high plus anterior optic is coupled with a 6.0-mm minus posterior optic of Visiogen	63
B:	Gross photographs of the synchrony IOL (Visiogen).	
C:	Synchrony Accommodative IOL (Visiogen, Irvine).	
D:	Synchrony AIOL preloaded to injector system.	
Figure 24:	Telescopic design of Visiogen	63
Figure 25:	Lens assembly of Sarfarazi	65
Figure 26:	Lens configurations of Sarfarazi	66
Figure 27:	Insertion in the bag of Sarfarazi	66
Figure 28:	SmartIOL	69
Figure 29:	SmartIOL is 9.5 by 3.5 mm	70
Figure 30:	The Smart IOL at different stages.	70
Figure 31:	Smart lens at different stages.	71
Figure 32:	The FlexOptic IOL has a mechanism of anterior movement by axial travel of the optic, in addition to optic shape change.	76
Figure 33:	The LiquiLens when positioned for distance vision. The LiquiLens when positioned for near vision	78
Figure 34:	PowerVision.	79
Figure 35:	Schematic showing the mechanism of action for the Power Vision IOL.	80
Figure 36:	PowerVision and its internal structures.	81
Figure 37:	Constructed prototypes & schematic of NuLens	85
Figure 38:	Mechanical model of the NuLens concept.	85
Figure 39:	Prototype of NuLens accommodating IOL with posterior aperture. Arrow is pointed to the hole for the flexible lens.	87
Figure 40:	Schematic description of the second-generation of NuLens accommodating IOL	90
Figure 41:	The NuLens real accommodating IOL.	90

Figure 42:	Foldable Silicone anterior accommodating IOL.	99
Figure 43:	Schematic of the lens-refilling procedure.	100
Figure 44:	Posterior accommodating IOL.	101
Figure 45:	A PCCC is created to prevent PCO. A posterior accommodating IOL is inversely implanted to seal the PCCC. Silicone polymers are injected between the 2 IOLs (AC IOL = accommodating intraocular lens; CCC = continuous curvilinear capsulorrhexis).	101
Figure 46:	The principle of preventing leakage of injectable silicone. The injected silicone polymer presses the IOL from the inside of the capsular bag against the CCC and anterior capsule (arrows). The injected silicone polymer did not leak through the space between the anterior capsule and IOL unless the IOL was pushed very far posteriorly (AC IOL = accommodating intraocular lens; CCC = continuous curvilinear capsulorrhexis).	102
Figure 47:	The AkkoLens	105
Figure 48 A:	Comparison of Current and AkkoLens Accommodating Intraocular Lenses Current accommodating intraocular lenses (AIOLs)	106
B:	Schematic of mechanism of AkkLens.	
Figure 49:	Schematic of Pixelated optics embedded in a parent IOL.	107

List of Table

Table	Title	Page
Table 1:	Published in vivo animal lens refilling experiments in chronological order.	97

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 Yttrium-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