Cataract and High Myopia

Egyptian Ophthalmological Society
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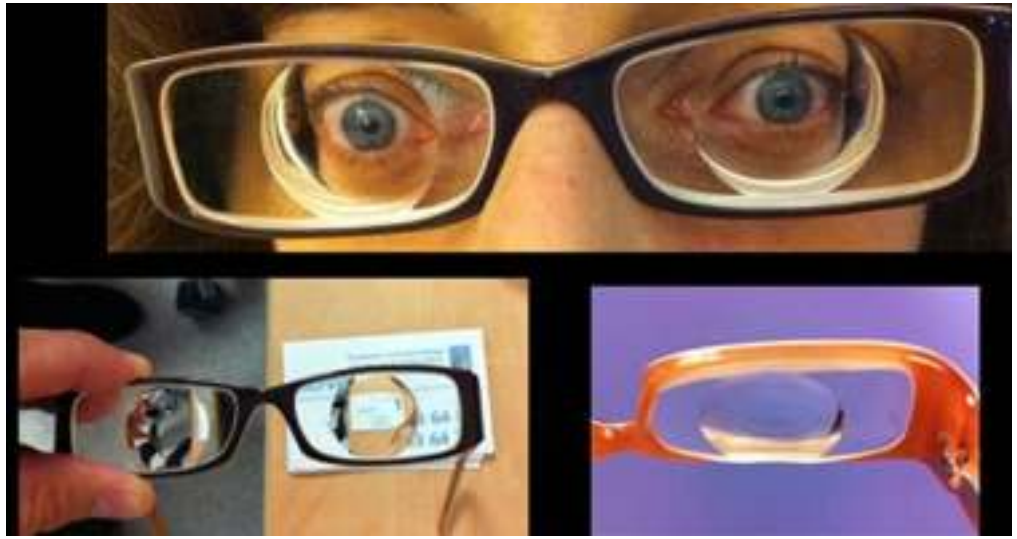
Intercontinental City Stars Cairo
Egypt



Dr S/E BENMOUSSA
Dr NH BENMOUSSA

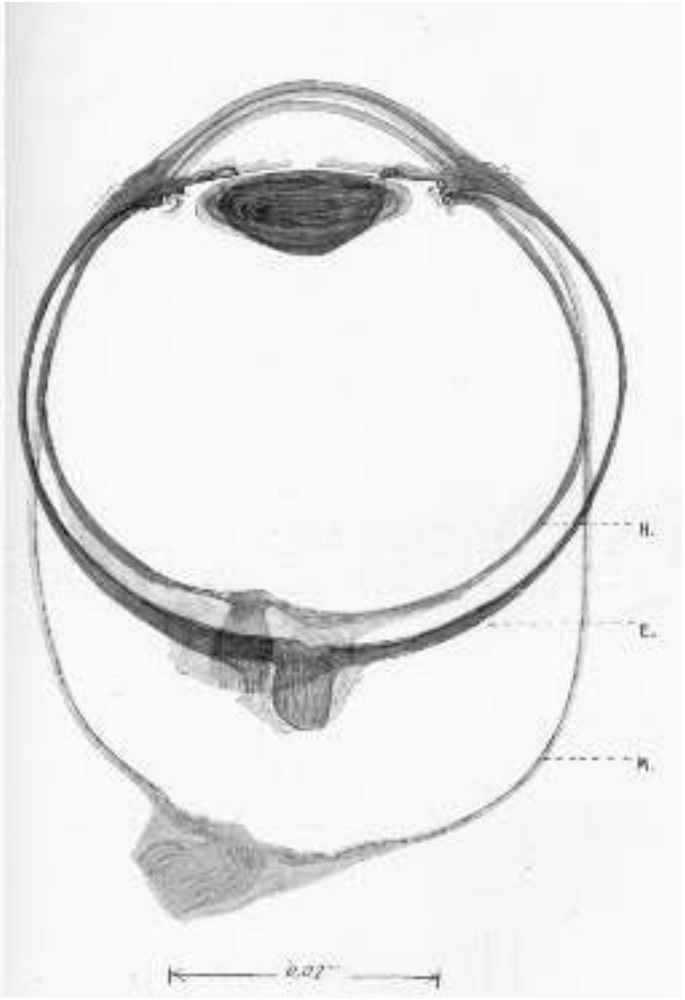
Khroub Constantine Algeria

www.clinique-ophtalmo-benmoussa.dz
Email: Cliniquebenmoussa@yahoo.fr

I- Introduction:

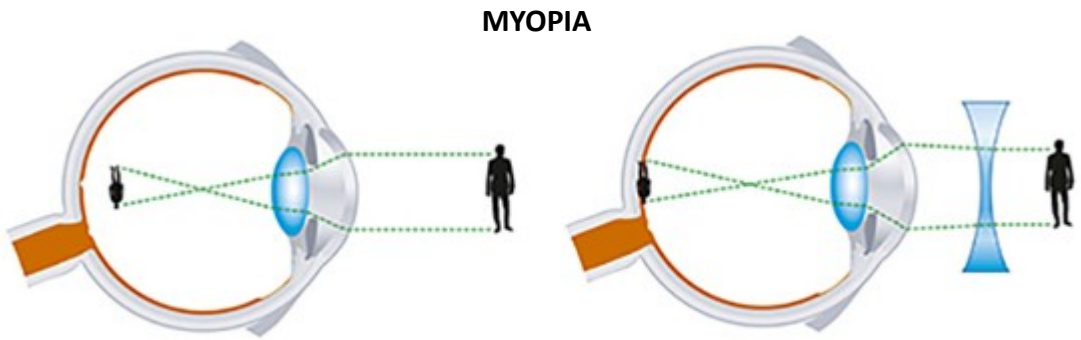
Myopia disease is a major risk factor in cataract surgery.

This condition is defined by an axial length of the eyeball > 26.5 mm.



Complications are mainly observed in cases with:

- Axial length ≥ 30 mm (-22.00 Dpt and more)
- Presence of a posterior staphyloma.
- Rupture of Bruch's membrane.
- History of retinal detachment, barred LPDR or laser.



What are the problems?

- Patient's personality, their requirements and expectations.
- Preoperative problems.

  - When should surgery be performed and at what stage?

  - Preoperative examination

  - Cataract grade

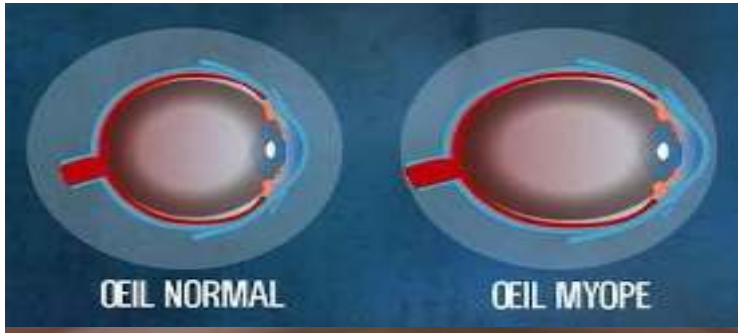
  - IOP correlated with the pachymetry:

  - State of vitreous retinal
  - Implant calculation

    - SRK/T and HAIGIS formula
    - Barrett
    - Holladay

Cataract surgery in high myopia is both a technical and refractive challenge.

- At a relatively early age.
- The prevalence of nuclear and posterior subcapsular cataracts is increased.
- The implant calculation is more delicate: refractive result, particularly of residual myopia.



II- Preoperative evaluation

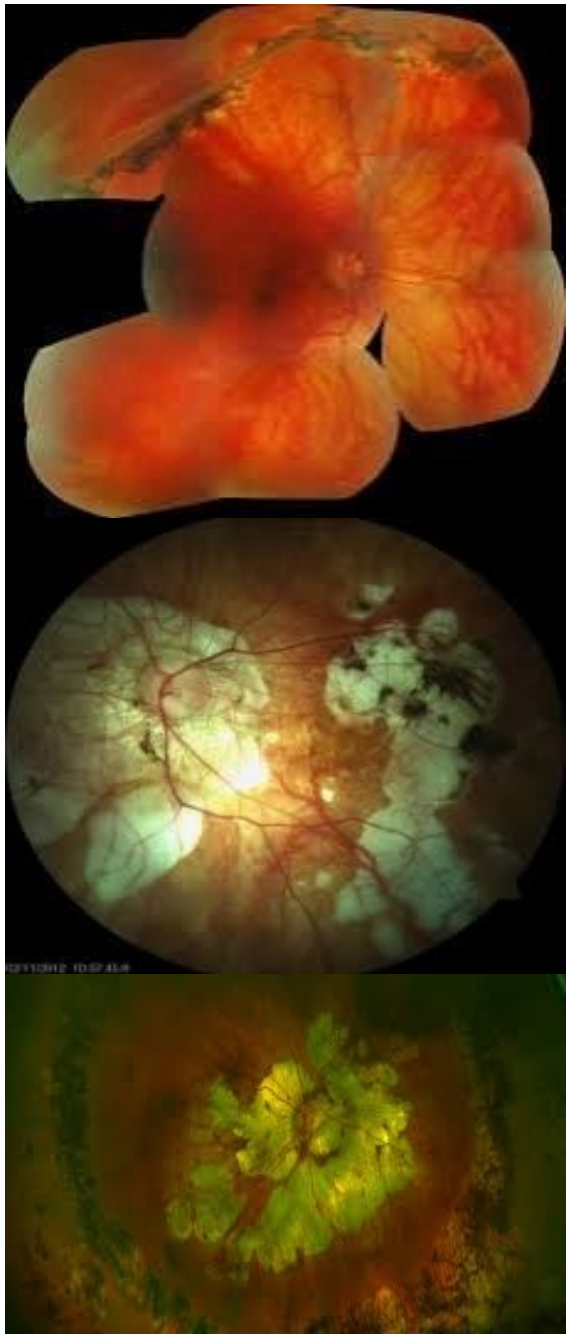
1 – Background of vitreoretinal pathologies and vitreoretinal surgeries

- Laser for LPDR, detachment of retina, treatment of macular neovascularization, glaucoma

- History of refractive surgery: PKR, TPRK Lasik, femto-Lasik

For the calculation of implant power

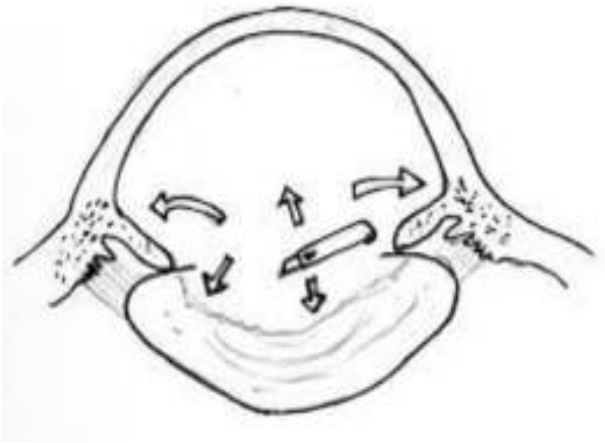
Troubles de la vue opérables et lasers



2- Examination of the Biomicroscopy of the Anterior Segment

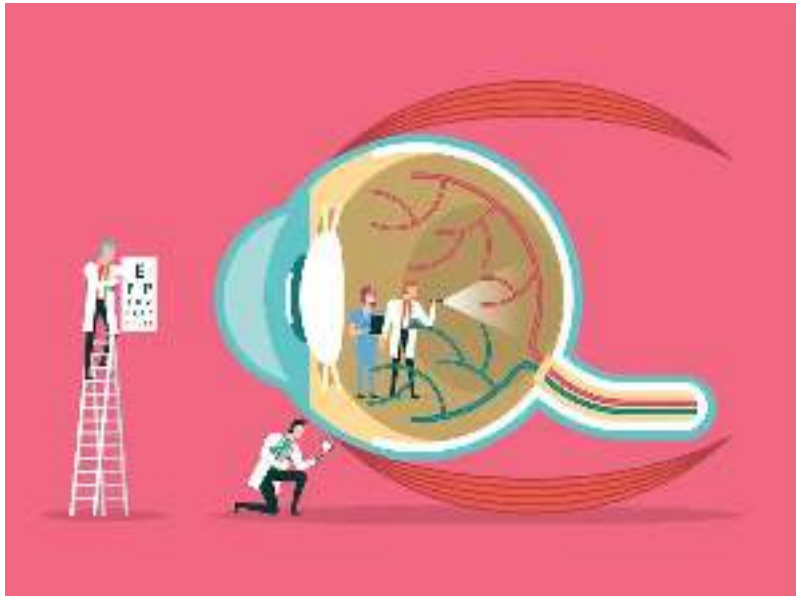
- Staging classification.

- Lens stability: subluxation, which allows the evaluation of the risk of the Lens-Iris Diaphragm Retropulsion Syndrome preoperatively.



- The zonule shows signs of fragility in 4.3% during the cataract surgery.

- Gonioscopy examination using a lens on a dilated pupil: highlighting signs of Zonular dehiscence which increases in the supine position and increases operative discomfort in the case of a deep anterior chamber.



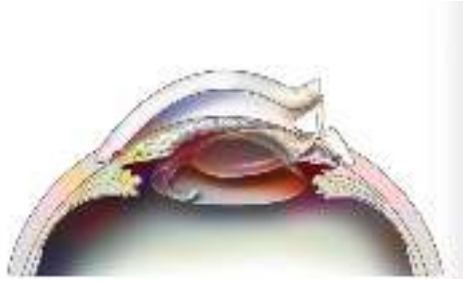
3- Examination of the posterior segment:

- Vitreous status: Posterior vitreous detachment: PVD

- Maculopathy: - Active choroidal neovascularization managed before cataract surgery
  - Foveoschisis

- Peripheral retinal analysis: risk of retinal detachment ranges from 1.3% to 8%

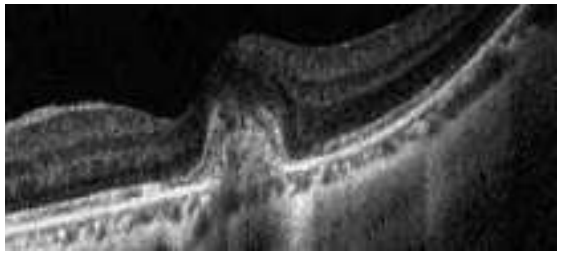
- Removal of the lens induces intraocular volumetric modifications, resulting in shifts and movements of the vitreous which could predispose to detachment of retina.



- (LPDR) lesions should be treated with photocoagulation.

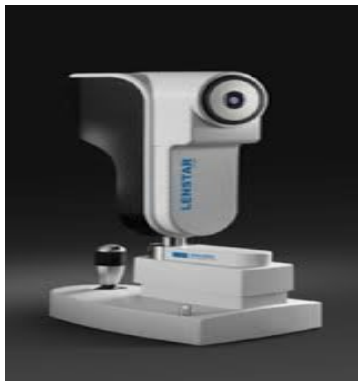
Akar S, Gok K, Bayraktar S, et al. Phacoemulsification in high myopia. Saudi Med J. 2010;31(10):1141–1145.

4- Additional Examinations:



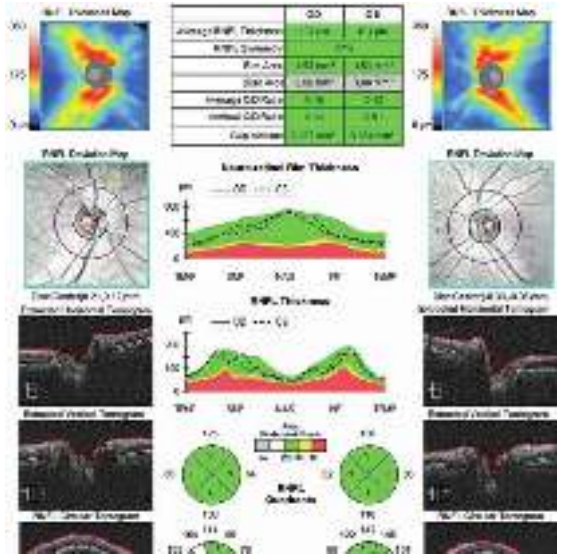
4-1 - Macular and optic disc OCT

4-2 - Pachymetry if correlated with HTO



4-3 - Specular microscopy

4-4 - Calculation of the Intraocular Lens power (IOL): Echo Biometrics:
- Optical



- IOL accuracy: residual myopia between -1.00 and 3.00 for high myopia.

Cetinkaya S, Acir NO, Centikaya YF, et al. Phacoemulsification in eyes with cataract and high myopia. Arq Bras Oftalmol. 2015;78(5):286–289.
Saka N, Ohno-Matsui K, Shimada N, et al. Long-term changes in axial length in adult eyes with pathologic myopia. Am J Ophthalmol. 2010;150(4):562–568.e1.

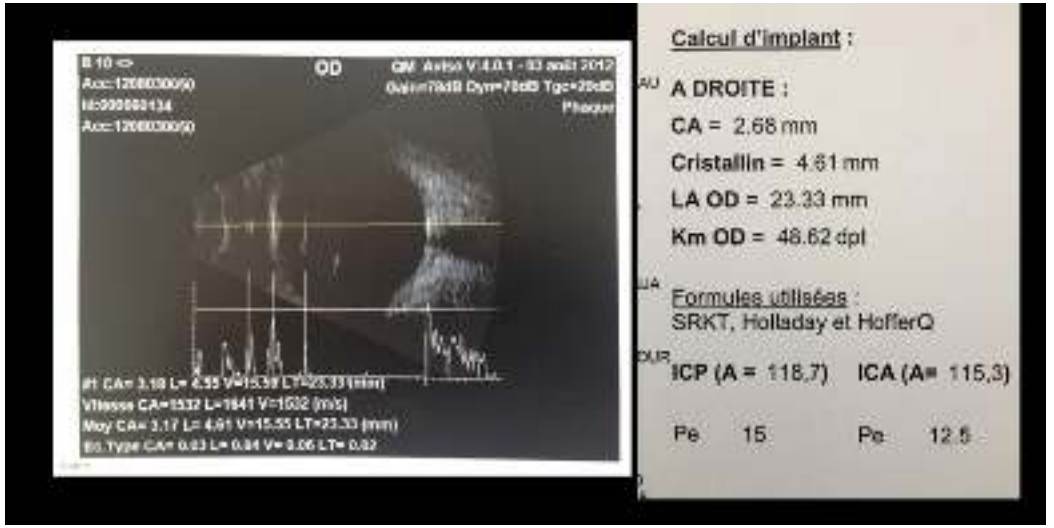
4-4-1- Echo Biometry:

a - Ultrasonic:

Manual, depends on the operator.

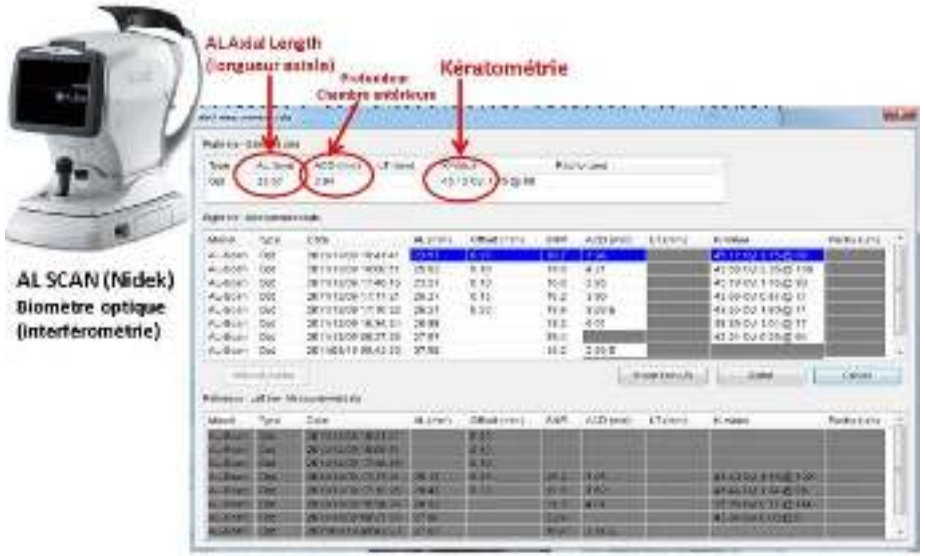
- In “B” mode:

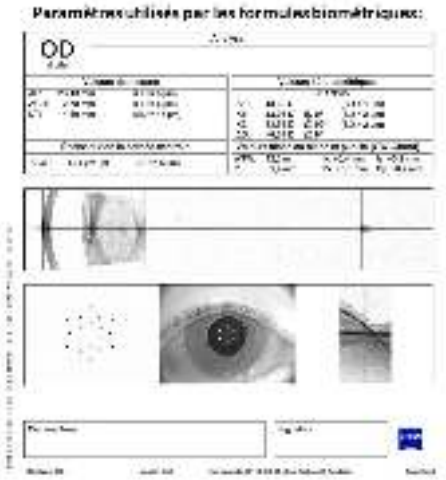
Allows anatomical data to be collected (axial length)



b - Optics (by interferometry)

Biometry aims to collect data to calculate (predict) the power of the intraocular lens (IOL)





4-4-2- Swept Source OCT

Comparison of 3 devices

- Study conducted on 119 patients (171 eyes) with cataracts:

Results: 166 eyes - 97.08% IOLMaster 700

- 97.08% OA 2000

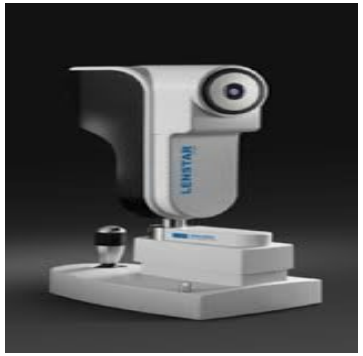
- 99.42% Argos

ORIGINAL ARTICLE

Open Access

Comprehensive Comparison of Axial Length Measurement With Three Swept-Source OCT-Based Biometers and Partial Coherence Interferometry

Jinhai Huang, MD, PhD; Hao Chen, MD; Yue Li, MD; Zhongxing Chen, MD; Rongrong Gao, MD; Jinjin Yu, MD; Yune Zhao, MD; Weicong Lu, MD; Colm McAlinden, MD, PhD; Qinmei Wang, MD



- Multifocality should be considered with caution.

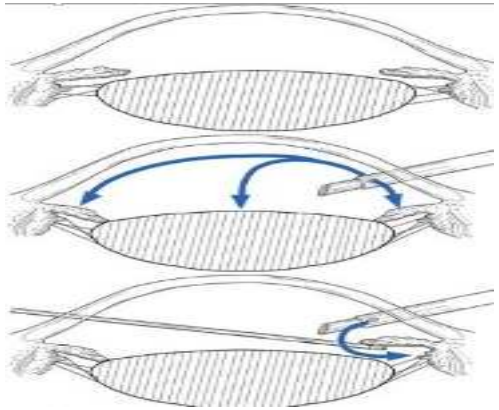
- ❖ 39.5% of patients had an emmetropic result ± 0.50 D
- ❖ 69.7% a ± 1.0 D which makes the multifocality uncomfortable




Cetinkaya S, Acir NO, Centikaya YF, et al. Phacoemulsification in eyes with cataract and high myopia. Arq Bras Oftalmol. 2015;78(5):286–289.
Zuberbuhler B, Seyedian M, Tuft S. Phacoemulsification in eyes with extreme axial myopia. J Cataract Refract Surg. 2009;35(2):335–340.

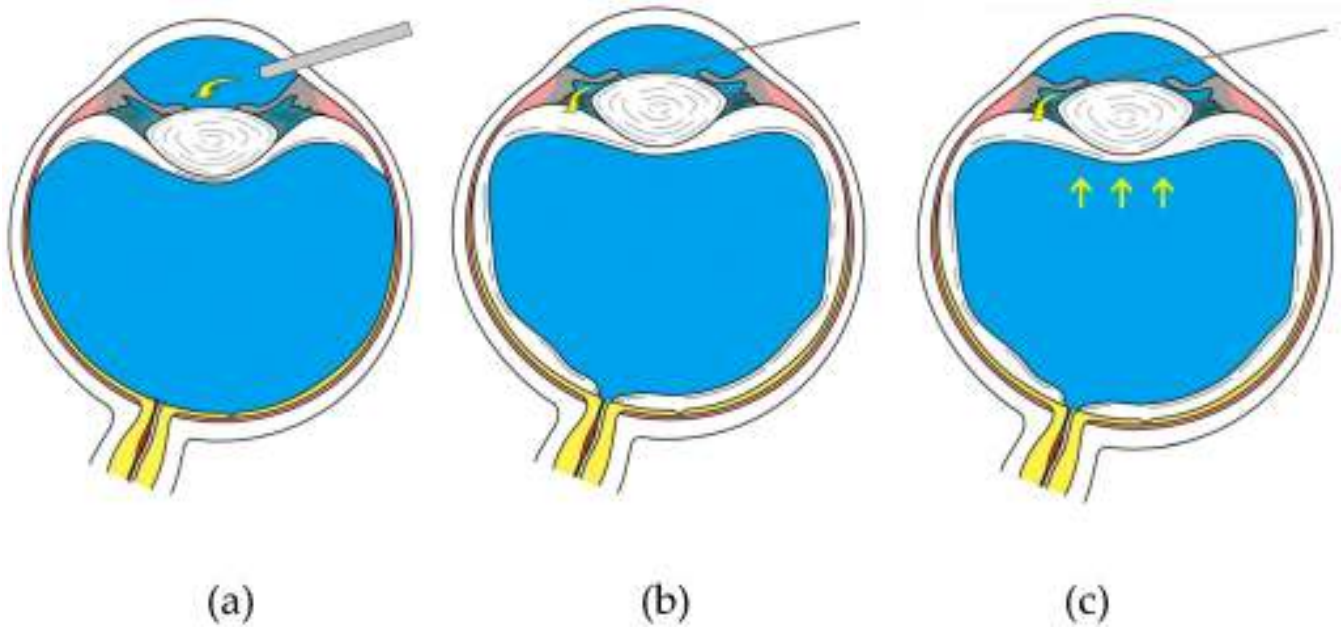
III- Time Operative

- Topical anesthesia
- Sub-Tenon's anesthesia
- Peribulbar anesthesia (outdated; risk of globe perforation).
- The fragile zonules and underdeveloped ciliary body cause significant backward displacement of the iris-lens diaphragm when irrigation is introduced into the anterior chamber.
- This leads to deepening of the anterior chamber, posterior bowing of the iris, and pupil dilation.
- These changes can cause intraoperative pain each time instruments enter and exit.



Hosoda Y, Kuriyama S, Jingami Y, et al. A comparison of patient pain and visual outcome using topical anesthesia versus regional anesthesia during cataract surgery. Wink Ophthalmol. 2016;10(6):1139–1144.
Zauberman H. Extreme deepening of the anterior chamber during phacoemulsification. Ophthalmic Surg. 1992;23(10):555–556.

- The stability of mydriasis is an important factor for the success of cataract surgery.
- The pathophysiology appears to be based on a pupillary block between the iris and the anterior capsule of the lens —either initially with the lens in place, or after lens extraction, between the iris and the anterior face of the residual capsular bag: 2.8% to 3% of cases.



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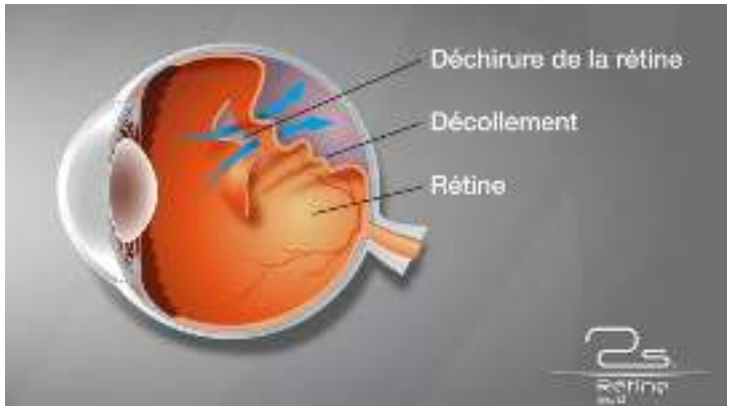
IV- Postoperative Monitoring



- Retinal detachment in the pseudophakic eyes
  - 0.4–1.02% at 3 years
  - Under 50 years old: 5.2%
  - High myopia (>15 D) _ 8%
    - Axial length >33.6 mm _11%

- Implantation helps reduce risk (limits anterior vitreous displacement and decreases traction on the retina).

- YAG laser capsulotomy even several years later.

Akar S, Gok K, Bayraktar S, et al. Phacoemulsification in high myopia. Saudi Med J. 2010;31(10):1141–1145.
Zuberbuhler B, Seyedian M, Tuft S. Phacoemulsification in eyes with extreme axial myopia. J Cataract Refract Surg. 2009;35(2):335–340.
Ripandelli G, Scassa C, Parisi V, et al. Cataract surgery as a risk factor for retinal detachment in very highly myopic eyes. Ophthalmology. 2003;110(12):2355–2361.
Colin J, Faucet H, Cochener B. Retinal detachment after clear lens extraction in highly myopic eyes: seven-year follow-up. Ophthalmology. 1999;106(12):2281–2284.
Arn J, Phakic intraocular lens implantation versus clear lens extraction in highly myopic eyes of 30- to 50-year-old patients. J Cataract Refract Surg. 2004;30(10):2092–2094.

V- Biometry and IOL Calculation in Myopic Patients

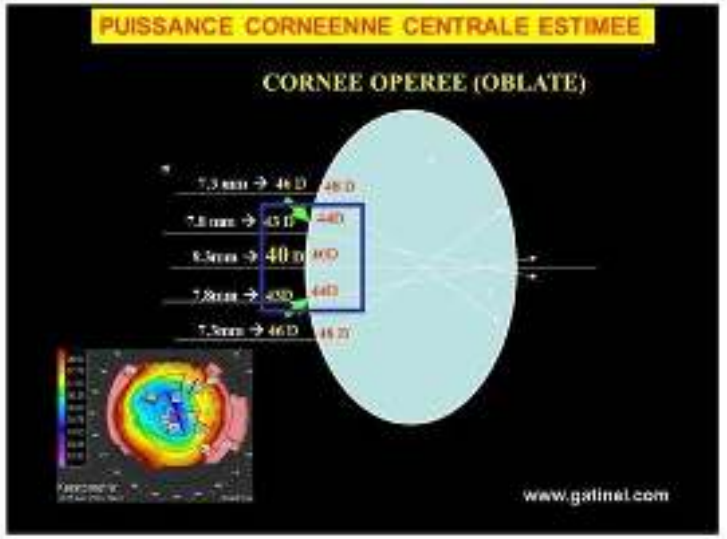
1- Examination:

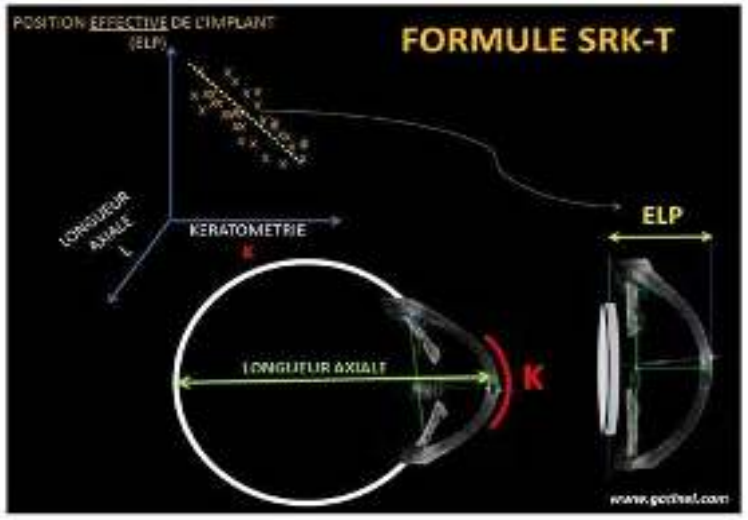
- Family and personal (general and ophthalmologic) history
- Use of glasses or contact lenses
- History of refractive surgery
- Patient’s activities (sports, leisure, work)
- Visual habits (distance, intermediate, near vision)
- Expectations and requirements

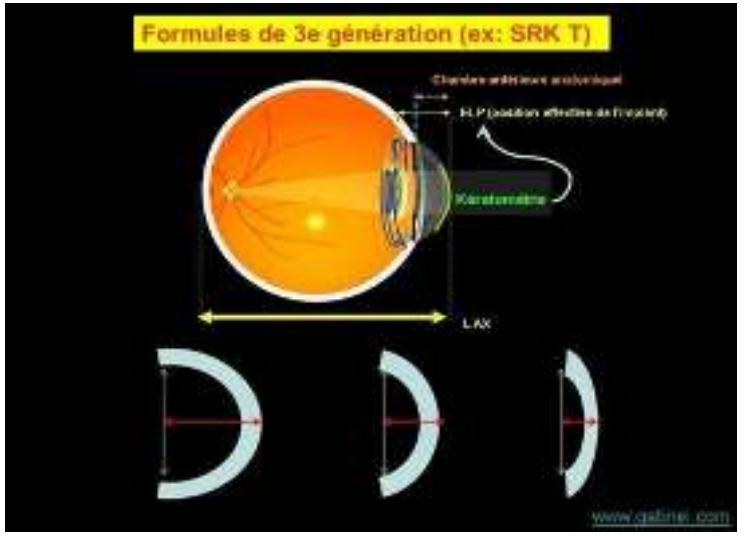
2- Formulas:

- **1st generation:** Mathematical models (Fedorov, Gauss)
- **2nd generation:** Based on regression (SRK I , SRK II)
- **3rd generation:** SRK/T, Holladay, Hoffer Q
- **4th generation:** Haigis, Olsen, Holladay II

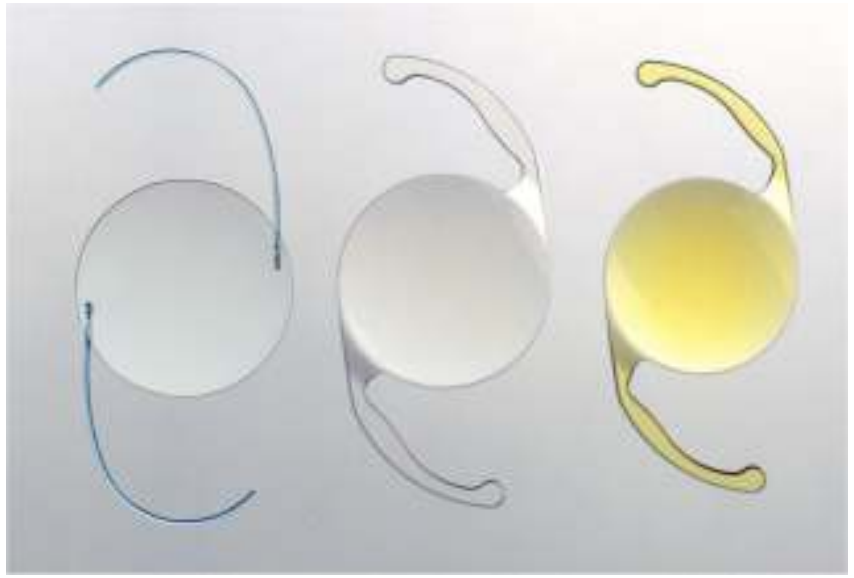
The most commonly used for high myopia is SRK/T, according to most authors.
Recently, in large cohorts: Barrett Universal II and Hill-RBF.







- SRK/T remains the reference formula; it is the most widely used.
- In cases with a history of refractive surgery, the Haigis formula provides good results.
- Optimization of the constant.
- Caution in case of negative implant: adapt A-constant accordingly.
- Be aware of the precision limits of biometry.
- Avoid a hyperopic shift.



SRK T : - UTILISE LA KERATOMETRIE POUR PREDIRE LA POSITION EFFECTIVE DE L'IMPLANT
- N'UTILISE PAS LA PROFONDEUR DE CHAMBRE ANTERIEURE PREOPERATOIRE

Fondation Rothschild — 15/12/2014 — 1,3375 — Plan — SRK/B/T — OK — 12,00 mm

Respectez les consignes sur la page suivante.

SRK T

OD (droite)	OS (gauche)
AL: 26,92 mm (SD = 13 µm)	AL: 26,99 mm (SD = 15 µm)
ACD: 3,67 mm (SD = 8 µm)	ACD: 3,75 mm (SD = 6 µm)
LT: 4,53 mm (SD = 36 µm)	LT: 4,53 mm (SD = 13 µm)
SE: 37,80 dpt	SE: 38,94 dpt
K1: 37,22 dpt @ 129°	K1: 38,85 dpt @ 150°
K2: 38,40 dpt @ 39° WTW: 12,7 mm	K2: 39,03 dpt @ 60° WTW: 12,5 mm
ΔD: -1,18 dpt @ 129° Acuité visuelle: ---	ΔD: -0,18 dpt @ 150° Acuité visuelle: ---
SIA: --- LVC: ---	SIA: --- LVC: ---
Ref: ---	Ref: ---
LS: Phaque; VS: Corps vitré	LS: Phaque; VS: Corps vitré

115.5 115.5		118.5 118.5		115.5 115.5		118.5 118.5	
Const.A:	115,50	Const.A:	118,50	Const.A:	115,50	Const.A:	118,50
IOL (D)	Ref (D)	IOL (D)	Ref (D)	IOL (D)	Ref (D)	IOL (D)	Ref (D)
+16,00	-0,95	+18,00	-0,66	+14,50	-0,75	+16,50	-0,60
+15,50	-0,52	+17,50	-0,29	+14,00	-0,34	+16,00	-0,23
+15,00	**-0,10**	**+17,00**	**+0,09**	**+13,50**	**+0,08**	**+15,50**	**+0,13**
+14,50	+0,32	+16,50	+0,46	+13,00	+0,49	+15,00	+0,49
+14,00	+0,73	+16,00	+0,82	+12,50	+0,89	+14,50	+0,85
Alcon SN60WF (Other)		ZEISS CT ASPHINA 509M (Acri.Smart 36A) (Other)		Alcon SN60WF (Other)		ZEISS CT ASPHINA 509M (Acri.Smart 36A) (Other)	
Const.A:	119,00	Const.A:	117,90	Const.A:	119,00	Const.A:	117,90
IOL (D)	Ref (D)	IOL (D)	Ref (D)	IOL (D)	Ref (D)	IOL (D)	Ref (D)
+18,50	-0,71	+17,50	-0,67	+17,00	-0,67	+16,00	-0,58
+18,00	-0,34	+17,00	-0,28	+16,50	-0,30	+15,50	-0,20
+17,50	**+0,03**	**+16,50**	**+0,10**	**+16,00**	**+0,06**	**+15,00**	**+0,17**
+17,00	+0,39	+16,00	+0,48	+15,50	+0,41	+14,50	+0,54
+16,50	+0,75	+15,50	+0,85	+15,00	+0,76	+14,00	+0,90

HAIGIS : - N'UTILISE PAS LA KERATOMETRIE POUR PREDIRE LA POSITION EFFECTIVE DE L'IMPLANT
- UTILISE LA PROFONDEUR ANATOMIQUE DE LA CHAMBRE ANTERIEURE (ACD)

Fondation Rothschild — 15/12/2014 — 1,3375 — Plan — Haigis Suite — OK — 12,00 mm

Respectez les consignes sur la page suivante.

HAIGIS

OD (droite)	OS (gauche)
AL: 26,92 mm (SD = 13 µm)	AL: 26,99 mm (SD = 15 µm)
ACD: 3,67 mm (SD = 8 µm)	ACD: 3,75 mm (SD = 6 µm)
LT: 4,53 mm (SD = 36 µm)	LT: 4,53 mm (SD = 13 µm)
SE: 37,80 dpt	SE: 38,94 dpt
K1: 37,22 dpt @ 129°	K1: 38,85 dpt @ 150°
K2: 38,40 dpt @ 39° WTW: 12,7 mm	K2: 39,03 dpt @ 60° WTW: 12,5 mm
ΔD: -1,18 dpt @ 129° Acuité visuelle: ---	ΔD: -0,18 dpt @ 150° Acuité visuelle: ---
SIA: +0,00 dpt @ 0° LVC: -	SIA: +0,00 dpt @ 0° LVC: -
Ref: ---	Ref: ---
LS: Phaque; VS: Corps vitré	LS: Phaque; VS: Corps vitré

115.5 115.5			118.5 118.5			115.5 115.5			118.5 118.5		
A0:	A1:	A2:	A0:	A1:	A2:	A0:	A1:	A2:	A0:	A1:	A2:
+1,210	+0,400	+0,100	+0,978	+0,400	+0,100	+1,210	+0,400	+0,100	+0,978	+0,400	+0,100
IOL (D)	Ref (D)		IOL (D)	Ref (D)		IOL (D)	Ref (D)		IOL (D)	Ref (D)	
+19,50	-0,85		+19,00	-0,73		+17,50	-0,62		+17,50	-0,85	
+19,00	-0,48		+18,50	-0,36		+17,00	-0,26		+17,00	-0,48	
+18,50	**-0,11**		**+18,00**	**+0,01**		**+16,50**	**+0,10**		**+16,50**	**-0,12**	
+18,00	+0,25		+17,50	+0,38		+16,00	+0,46		+16,00	+0,24	
+17,50	+0,61		+17,00	+0,74		+15,50	+0,81		+15,50	+0,60	
Alcon SN60WF (Other)			ZEISS AT LISA 809M (AT LISA 366D) (Other)			Alcon SN60WF (Other)			ZEISS AT LISA 809M (AT LISA 366D) (Other)		
A0:	A1:	A2:	A0:	A1:	A2:	A0:	A1:	A2:	A0:	A1:	A2:
-0,769	+0,234	+0,217	+0,675	+0,028	+0,149	-0,769	+0,234	+0,217	+0,675	+0,028	+0,149
IOL (D)	Ref (D)		IOL (D)	Ref (D)		IOL (D)	Ref (D)		IOL (D)	Ref (D)	
+20,00	-0,57		+18,50	-0,74		+18,50	-0,76		+17,00	-0,86	
+19,50	-0,22		+18,00	-0,35		+18,00	-0,41		+16,50	-0,48	
+19,00	**+0,13**		**+17,50**	**+0,02**		**+17,50**	**-0,06**		**+16,00**	**-0,10**	
+18,50	+0,48		+17,00	+0,40		+17,00	+0,28		+15,50	+0,27	
+18,00	+0,82		+16,50	+0,77		+16,50	+0,62		+15,00	+0,64	

3- Summary of formulas to use according to axial length (SFO)

- **From 22.5 to 24.5 mm (72% of the population): all formulas**

- **> 24.5 mm (20% of the population)**
  - **SRK-T**
  - **Haigis, Olsen, Barret (PCI)**
  - **Osen (OLCR)**

- **< 22.5 mm (8% of the population)**
  - **Hoffer Q, Holladay**
  - **Barrett (PCI)**
  - **Olsen (OLCR)**

OLCR: Optical Low-Coherence Reflectometry
PCI: Partial Coherence Interferometry

VI- Conclusion:

- The incidence of cataracts is higher and occurs earlier in cases of high myopia.
- The preoperative exam—patient interview, clinical exam, and implant calculation—are key to success.
- The refractive result and patient satisfaction are the main goals.
- Postoperative monitoring is important to detect retinal complications.

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