

PhD dissertation theses

New operation methods and their application in the anterior segment
surgery of the eye

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Introduction

The most numerous operative medical intervention for the last two decades has been worldwide the surgery of cataract. In the countries of the European Community a yearly two million operation is being executed, in our country is this number growing, it's approaching to fifty thousand.

The history of cataract surgery goes back twenty six centuries. The first reference is in the Hindistan medicine, in the papers of Susruta. Susruta gives an exact anatomical and pathological description of the eye, knows several sorts of cataract. He describes the cataract stich, which is better characterised by the expression reclination lentis of Celsus. This was the only operation up to the XVIII century a.d.

The first surgeon, who extracted the lens from the retroirideal space was Jaques Daviel, he published his method in 1748. He made a big incision with a spade and a scissor in the inferior limbus, having opened the capsule he expressed the lens- this method is called extracapsular cataract extraction. 1753 he reports his first 115 cases 100 of which were successfull-very convincing compared to cataract stich.

Nearly the same time, in 1753, Samuel Sharp from London demonstartes the total removal of the lens (intracapsular cataract extraction, ICCE): he expresses the lens with his thumb. Complication of the expression is the high vitreous prolaps rate, this method wins space only after Pagenstecher's modification with forceps extraction in 1871.

The suture of the cataract wound 1867 (Willlams), the introduction of drop anaesthesia 1884 (Koller), even more the retrobulbar block 1928 (Elschnig) and the oculopression (Kettesy, Vörösmarthy) led to the wide spread of the intracapsular technique. This technique reached the top with the kryoextraction in 1961 and then it seemed not to have an alternative (Krwawicz).

In the second half of the 20th century other possibilities also ocured.

The historical first successful intraocular correction of aphakia is done in 1949 (Ridley). The material is polymethylmetacrylat: a congenial observation from the second world war: british flyers tolerated well the intraocular windscreen splitters. (Györffy István publishes in 1938 the high biocompatibility of this material). Although many successfull implantations, Ridley has been permanently attacked, he gives up in 1964. The acknowledgement comes 30 years later.

In the meantime, lens implantation goes another way: Strampelli constructs in 1953 an angle supported anterior chamber lens. This lenses, as well as their late descendents, cause corneal decompensation, secondary glaucoma, inflammation. Binkhorst fixates the lens to the iris. In 1977 Pearce goes back to the idea posterior chamber implantation, his lens is fixated in the capsular bag with flexible feet (haptics). Since that time this has been regarded the optimal lens implantation, although the ideal lens has not yet been formed, which fact is proved by the many coexisting models.

Harms and Mackensen introduced the microscope technique in 1953, they elaborated for the new horizons the new operation technique, new tools, new sutures.

Kelman elaborates in 1967 the method of phacoemulsification. The liquifying with ultrasound and aspiration of the lens nucleus intraocularly reduced the wound to 3 mm. The little wound was followed by foldable lenses made from PMMA copolymers and silicon.

Goals

1. To elaborate a capsule opening technique for extracapsular extraction that reduces the danger of non-controlled capsular tear, makes secure the removal of the cortex. To examine the security of bag implantation and the capsular fibrosis rate
2. To elaborate a phacoemulsification teaching strategy for reducing complications during the learning period.
3. The application of the tunnel wound in the clear cornea.
4. To elaborate a phacoemulsification technique, that reduces ultrasound application by using it only in occlusion.
5. To elaborate a filtering technique to the sclerocorneal tunnel.
6. To elaborate an operation for after cataract that saves the posterior capsule, the main advantage of the extracapsular extraction.
7. To apply small incision surgery in cases of subluxated, luxated lenses.
8. To elaborate intraoperative pressure reduction in cases of phacolytical glaucoma, the application of the tunnel wound for these cases.
9. The construction of an instrument that manipulates the lens from behind.
10. To elaborate a method for tonisation of the globe in cases of corneal perforation to perform a controlled host trephination.

Methods

1. Modified capsulotomy

Operation technique

Corneoscleral incision at the XIIh position, basal iridectomy, optional sphincterotomy, viscoelastical mydriasis. Opening of the anterior capsule with spade 3mm superior to the centrum, from both ends of the incision elongation in the direction of III és IX h. The goal of this modification is that an eventual uncontrolled tear should reach the lens aequator on a longer way.

The modified capsulotomy was executed on 39 eyes of 35 patients. Pupil size was 2,5-4,0 mm. Intra- and postoperativ complications, visual acuity, ocular tension were compared with the data of 45 eyes, 30 of which were operated with the classical envelop technique, 15 with Neuhann's capsulorhexis. In the last second group the pupil size was in every case above 6 mm.

2. Flattening of the cataract operation learning curve

The intraoperative complications of 5695 cataract operations performed in the years 1992-1995 were evaluated. The operations were done by 8 surgeons, divided into three groups:

A group more than 500 operations/year

B group 150-500 operations/year

C group less than 150 operation/year

Difficult cases (pupil smaller than 4mm, complicated or traumatic cataract, zonulodialysis, pseudoexfoliation, intumescent or hypermature cataract, brown nucleus) were extra evaluated.

3. About the corneal tunnel technique

Since October 1992 the new tunnel wound has been corneally performed in cases where corneal incision had been used earlier: after filtering operations or on patients with anticoagulant therapy. Corneal tunnel was also used for traumatic cataract and secondary implantation. This wound technique was called later CCI (clear corneal incision).

0,3 mm deep limbus parallel cut at the edge of the vessels 3,5-6,0 mm long depending from the size of the lens to be implanted. Max 2,0 mm long horizontal preparation with diamond knife, steep opening of the chamber with a spade.

In our study 82 eyes of 78 patients were examined, having been operated between October 1992 and February 1993. Follow-up time was 3-7 months.

4. V style phakoemulsification technique

1. Beginning from the XIIh position two grooves towards IVh and VIIIh (aspiration 200 Hgmm) with low ultrasound energy, till red reflex appears. The grooves should be prolonged till the nuclear rim is broken. This way we gain a piece of cake that contains the hardest center.

2. This free central part will be emulsified from the depth. In this phase the phaco tip does not leave the center, there is no zonular stress.

3. The remaining cortical and epinuclear segments should be rotated 180° and can be removed with medium ultrasound energy and aspiration

750 eyes of 633 patients were operated between October 1991 and February 1992. (selected cases, in this period difficult cases were operated by ECCE).

5. Sclerocorneal tunnel and filtering operation

Conjunctiva preparation in the limbus, sclerocorneal tunnel, routine V style phacoemulsification, irrigation-aspiration, bag implantation. Exploration of the posterior sclera layer by Healon, triangle sclerectomy 0.5 mm centrally. Through this opening peripheral iridectomy. Closing of the tunnel wound through the limbal incision.

32 eyes of 26 patients (mean age 78 (58-90)) were operated between October 1991 and February 1992 with this combined operation. Follow-up time was 4 weeks to 5 months.

6. Aspiration of soft after cataract on pseudophacic eyes

Filling of the anterior chamber through a limbal incision with Healon. Scraping and aspiration of the regenerates with silicon cannula as wide as possible. Removal of Healon by irrigation.

The operation takes two-three minutes. Getting behind the lens needs an experienced hand.

102 eyes of 96 patients were aspirated between March 1996 and January 1997. Mean age was 73,5 years (55-87). Follow-up time 18-27 months.

7. Phakoemulsification of the subluxated and luxated lens

1. Sclerocorneal tunnel
2. Limbal paracentesis-maintainer
3. Removal of the vitreous from the anterior chamber with vitreous stripper
4. Reposition and sustaining of the lens through the pars plana with viscoelastic device.
5. Filling of the anterior chamber with viscoelastic material
6. Minirhexis
7. Endocapsular phakoemulsification. During phaco procedure the lens can be supported with a silicon cannula induced through the pars plana. The lens should be reduced so that it can be pulled out with the capsule through the 5,5mm sclerocorneal tunnel.
8. Implantation of an iris-claw lens

8. Operative solution of phacolytical glaucoma

Blind pars plana decompression with a vitreous stripper 4,0mm posterior to the limbus through a 0,9mm wound. 7,0mm sclerocorneal tunnel incision, irrigation-aspiration of the anterior chamber, removal of the membrane from the iris and the angle, modified capsulotomy, luxation of the nucleus in the anterior chamber, extraction with Weber-hook after viscoelastic tamponade, irrigation-aspiration of the cortex, PMMA lens implantation.

Between 1989-98 four phacolytical glaucoma cases were diagnosed. The anamnesis in the case of the four women (58, 82, 83, 86 years old) was sudden onset strong pain in the eye with several years of extremely bad vision. Visual acuity was in all cases hand movement with bad light perception and localisation.

9. The inverse position hook

As an opposite to Sinsky-hook the inverse position hook was constructed. It differs from the Sinsky-hook with the end designed upwards.

It can be induced through a limbal paracentesis, through a sclerocorneal or corneal tunnel and a pars plana paracentesis as well.

During the six year use it has been proved useful. No modification was needed, we still use the prototype produced by Duckworth and Kent. The dropped lens can be lifted from the vitreous or from the retrocapsular space. The in the bag impacted lens can be cautiously freed. The haptic can be pulled out for lens stabilisation to divide it for explantation. All lens models can be manipulated by the inverse position hook.

10. Healon5 tamponade during keratoplasty

3,0ml peribulbar injection with a mixture of lidocain- bupivacain hydrochlorid, no ocular pressure. Anterior chamber filling through a paracentesis with sodium hyaluronat (Healon5). Trephination of the host with an Asmotom motor laborated suction trephine at 10 Hgmm vacuum. Fixation of the graft with 10/0 running suture.

Perforating keratoplasty was executed in five cases on spontaneously perforated eyes with this method. We could successfully trephine the host in every case over 180°.

New results

1. A new capsule opening method was elaborated for the extracapsular extraction, that makes the procedure safe, reduces the risk of capsular fibrosis, we proved this with comparing clinical examination.
2. A teaching method for phacoemulsification technique was developed, that enables a learning period with few complications, we proved this with the analysis of the results of six beginning surgeons.
3. Using the sclerocorneal tunnel in the clear corneal region, we proved it's safety. Our observation is proven by the spread of the clear corneal incision.
4. We elaborated a new phacoemulsification technique (the V style technique) and proved it's safety.
5. A filtering operation was adapted for sclerocorneal tunnel incision, we proved it's effectiveness with the results of 32 combined operations.
6. For soft after cataract we elaborated an operation that saves the integrity of the posterior capsule, with the follow-up of our patients we proved, that neither cystoid macular edema, nor retinal detachment occurred.
7. We elaborated a phacoemulsification technique for luxated and subluxated lenses, we proved it's safety and effectiveness in 14 cases.
8. For phacolytical glaucoma the steps of modern cataract surgery were adapted (tunnel incision, use of viscoelastic material). Against the high vitreous pressure the pars plana decompression was described, which was successfully used in other cases (expulsive bleeding, malignant glaucoma) as well.
9. For lens manipulation from behind a new hand instrument, the inverse position hook, was constructed and clinically proven.
10. A new method was elaborated for the trephination of the perforated cornea based on the injection of high viscosity viscoelastic material, the effectiveness was proved in 5 cases.

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