# Slit Lamp Examination


**Gernot Steinwender and Andreas Wedrich**

Accurate preoperative diagnostics are essential for patient selection and surgical planning. The assessment of the anterior eye segment is of particular importance, as this is the location of the most relevant refractive structures. Even though imaging diagnostics advanced fundamentally in the last decade, the slit-lamp microscope still is an indispensable preoperative instrument.

During preoperative slit-lamp examination, a macroscopic assessment of the **periocular region** should be performed in addition to the microscopic examination. Findings that may potentially complicate the surgical procedure, such as deep-set eyes or prominent brows, can be identified. Eyelid malpositions relevant for lens surgery are described in detail in Chap. "Eyelids". When assessing the **eyelids**, attention should be paid to signs of blepharitis, which should be treated prior to surgery. Even in the presence of meibomian gland dysfunction, preoperative treatment with warm compresses, lid massages and lid scrubs as well as anti-inflammatory therapy may alleviate dry eye symptoms which are typically exacerbated by lens surgery [1].

Disorders of the ocular surface and **tear film** are common in patients presenting for lens surgery. Thus, the assessment should include instillation of fluorescein drops to determine the tear film break-up time (TBUT) and to detect epitheliopathy. Regardless of whether a monofocal or multifocal intraocular lens (IOL) is implanted, the optical quality after lens surgery may be impaired by aggravation of ocular surface disorders in the first postoperative months [2]. For a detailed description of this topic refer to Chap. "Tear Film Analysis". When inspecting the **conjunctiva**, attention should be paid to irregularities of the bulbar conjunctiva (e.g. scars after strabismus or glaucoma surgery, pinguecula), which may lead to

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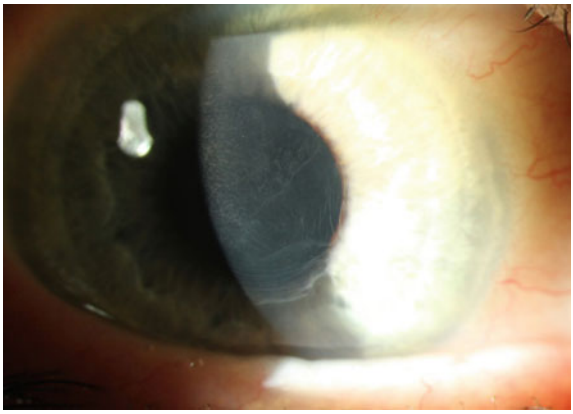

**Fig. 1** Epithelial basement membrane dystrophy with fingerprint-like lines and geographic lesions

suction problems when attaching the patient interface to the eye in femtosecond laser-assisted cataract surgery.

The **cornea** as the most important refractive structure should deserve particularly careful examination. Corneal dystrophies, scars or pterygium may have an impact on the visual result after lens surgery. Epithelial basement membrane dystrophy (EBMD) (Fig. 1) can lead to clinically significant changes in keratometry values [3] as well as to fluctuations in postoperative refraction and visual acuity. For these reasons, the use of multifocal IOLs is not recommended in patients with EBMD, as the postoperative result could be severely impaired. Furthermore, toric IOLs should only be considered in EBMD patients if consistent keratometry values can be achieved with different measuring devices over several days. Pre-treatment with phototherapeutic keratectomy (PTK) in symptomatic patients often leads to an alleviation of visual complaints, although the condition may recur [4].

Patients with Fuchs' endothelial dystrophy (Fig. 2) should not be considered eligible for multifocal IOLs, as the optical quality may be impaired even in early stages [5]. It is known that implantation of multifocal IOLs potentially decrease contrast sensitivity in otherwise healthy eyes [6]. Consequently, the reduced optical quality is not likely to be outweighed by the potential benefits of a multifocal IOL in Fuchs' dystrophy, especially considering the progressive course of the disease. When using toric IOLs in patients with Fuchs' endothelial dystrophy, special consideration should be given to potential alterations of corneal astigmatism by a subsequent endothelial keratoplasty [7].

Corneal scars require further diagnostic measures to fully examine location, depth and induced astigmatism. Peripheral asymptomatic scars do not represent a contraindication for multifocal or toric IOL implantation. In the presence of pterygium, active progression should be ruled out and the potential impact on the visual outcome should be reflected in IOL selection.

When assessing the **iris**, attention should be paid to signs of intraocular inflammation (synechiae, iris pigment deposits on anterior lens surface) and pigment dispersion (iris transillumination) (Fig. 3). Patients with iris atrophy have an increased risk of postoperative dysphotopsia (e.g. glare) and zonular instability (caused by previous inflammation) for both multifocal and monofocal IOLs. Phakic

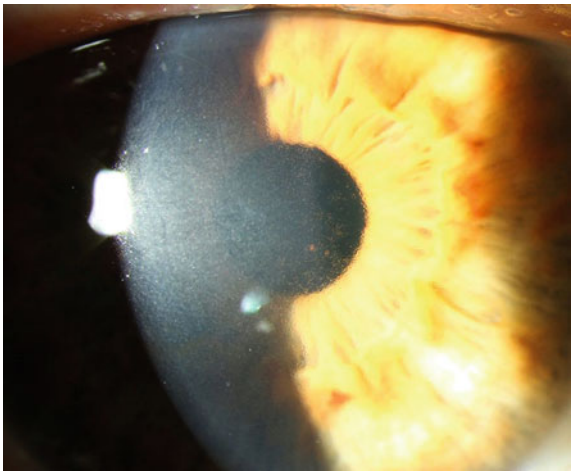

**Fig. 2** Fuchs' endothelial corneal dystrophy with guttata on the back of the cornea

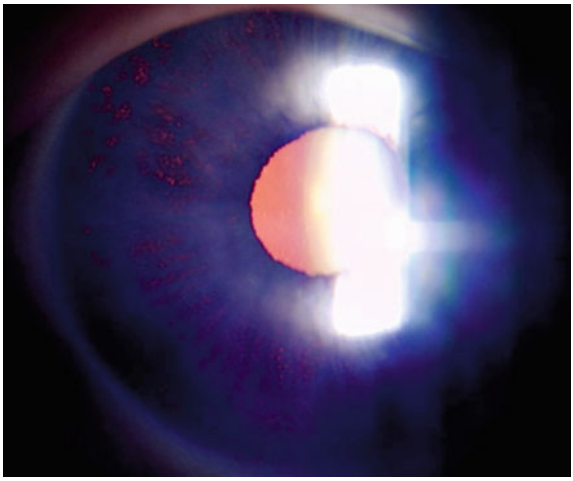

**Fig. 3** Iris transillumination due to pigment defects of the iris

IOLs should not be implanted in patients with iris atrophy or pigment dispersion syndrome, as direct contact between the IOL and the iris can potentially induce inflammatory reactions and increased pigment dispersion [8]. Iridodonesis at the margin of the undilated pupil is a sign of reduced zonular integrity and therefore may alter the surgical plan.

A small pupil can lead to difficulties with IOL implantation. Intraoperative application of pupil dilating techniques (e.g. Malyugin ring, iris hooks) can damage the iris sphincter and subsequently lead to iatrogenic mydriasis, which may lead to disturbing reflections and dysphotopsias, especially in multifocal IOLs [6]. More complex pupillary anomalies such as eccentric pupils or iris colobomas are considered a contraindication for multifocal IOLs, since a dislocated capsulorhexis is a risk factor for IOL decentration which may impair IOL function [9].

The depth of the **anterior chamber** should be determined preoperatively, as presence of a shallow anterior chamber might indicate a narrow angle, a very short eye or even nanophthalmos, an intumescent cataract, or ciliary body pathology leading to a forward displacement of the iris-lens diaphragm. Gonioscopy should be performed to detect angle abnormalities like neovascularisations or peripheral anterior synechiae. In presence of a closable angle, removal of a relatively clear lens can also be considered to create more space in the anterior chamber.

Special attention should be paid to the examination of the **lens**. Pupil dilation for assessing the extent of lens opacification is essential prior to lens surgery. Brunescent cataracts are advanced nuclear cataracts that appear brown and opaque but may sometimes be associated with remarkably good visual acuity. Nevertheless, the hard nucleus of such lenses may require a high amount of phacoemulsification energy and may require adaptions of the surgical plan. Advanced cortical cataracts becoming white and opaque are called mature cataracts. Progressive swelling of the cortical cataract due to water up take leads to intumescent cataract, which is associated with a higher risk of complications, particularly during the capsulorhexis. Posterior subcapsular cataracts often appear in patients younger than those presenting with cortical or nuclear cataract and can best be detected by retroillumination.

In the absence of significant lens opacification, the implantation of myopic phakic posterior chamber IOLs represents an interesting alternative to refractive lens exchange, as the manufacturer recently expanded the age range for patients up to 60 years.

Signs of zonular instability should be examined and documented prior to lens surgery. With multifocal IOLs in particular, patient satisfaction is strongly dependent on proper implantation and centration of the IOL. A decentration of as little as 0.75 mm may lead to a significant reduction of postoperative optical quality [10]. The most common reason for IOL decentration is pseudoexfoliation syndrome (PEX) [11] (Fig. 4). In characteristic asymmetrical zonular instability, the IOL shifts away from the weakened area towards the intact fibres. Thus, the stability regarding IOL centration and rotation is not predictable in PEX patients and may change over time. To avoid these issues, multifocal and toric IOLs are not recommended in patients with PEX. The use of a capsular tension ring during lens surgery distributes forces along the equator of the lens capsule more evenly in eyes with modest asymmetrical zonular weakness and therefore has a stabilising effect on the IOL position, though it does not reduce the long term risk of IOL luxation. In eyes at risk, the simultaneous use of a capsular tension ring during implantation of toric or multifocal IOLs significantly improved visual outcomes [12].

**Author's recommendation**

In the presence of pseudoexfoliation syndrome, the use of multifocal or toric IOLs is not recommended due to an increased risk of subsequent IOL decentration or rotation.

Biomicroscopic examination of the anterior segment should always be followed by dilated fundoscopy to assess the posterior segment prior to lens surgery. This is not only to identify potentially limiting conditions, but also to document random

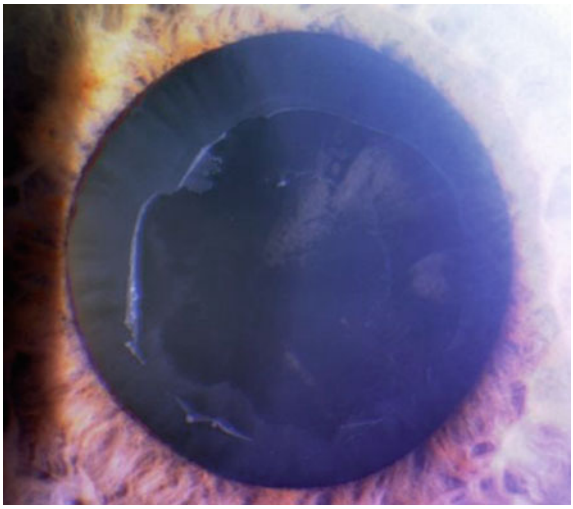

**Fig. 4** Pseudoexfoliation syndrome with typical deposits on the anterior lens capsule

findings primarily without causal impact on the visual result, but which can be interpreted by the patient as being causal if problems arise at a later stage.

In the presence of **retinal** disease, the patient selection for multifocal IOL implantation depends primarily on the expected course of the disease. Potential issues that may arise include both a reduced visual outcome for the patient and reduced visualisation of the posterior eye segment for the treating ophthalmologist. While retinitis pigmentosa and Stargardt's disease are classified as absolute contraindications for the use of multifocal IOLs, the more frequent maculopathies, such as diabetic retinopathy, age-related macular degeneration or epiretinal membranes, can have a wide range of presentations which may still be compatible with some multifocal lenses [13, 14]. A crucial criterion for patient selection is the progression of retinal diseases after cataract surgery. These diseases lead to a loss of contrast sensitivity, which can be exacerbated by the further reduction of contrast sensitivity associated with the implantation of multifocal IOLs. Signs of myopic maculopathy should also be documented and discussed with the patient, although good results can be achieved for highly myopic patients after multifocal IOL implantation [15].

Peripheral retinal degenerations are not uncommon in patients (often myopic) prior to lens surgery and should also be documented and discussed. A correlation between such lesions with an increased risk for retinal detachment has not been confirmed [16] and prophylactic laser coagulation should only be performed after individual consideration of all risk factors (patient age, degree of myopia, type of degeneration, presence of vitreous detachment, complication risk of lens surgery).

Anomalies of the **optic nerve** that can potentially limit visual acuity, contrast sensitivity, colour perception or visual field are generally considered as contraindications for the use of multifocal IOLs, particularly in progressive diseases such as glaucoma [17]. The implantation of phakic IOLs is also contraindicated in manifest glaucoma, since (especially in sulcus-fixated models) sporadic increases in intraocular pressure have been described [8].

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