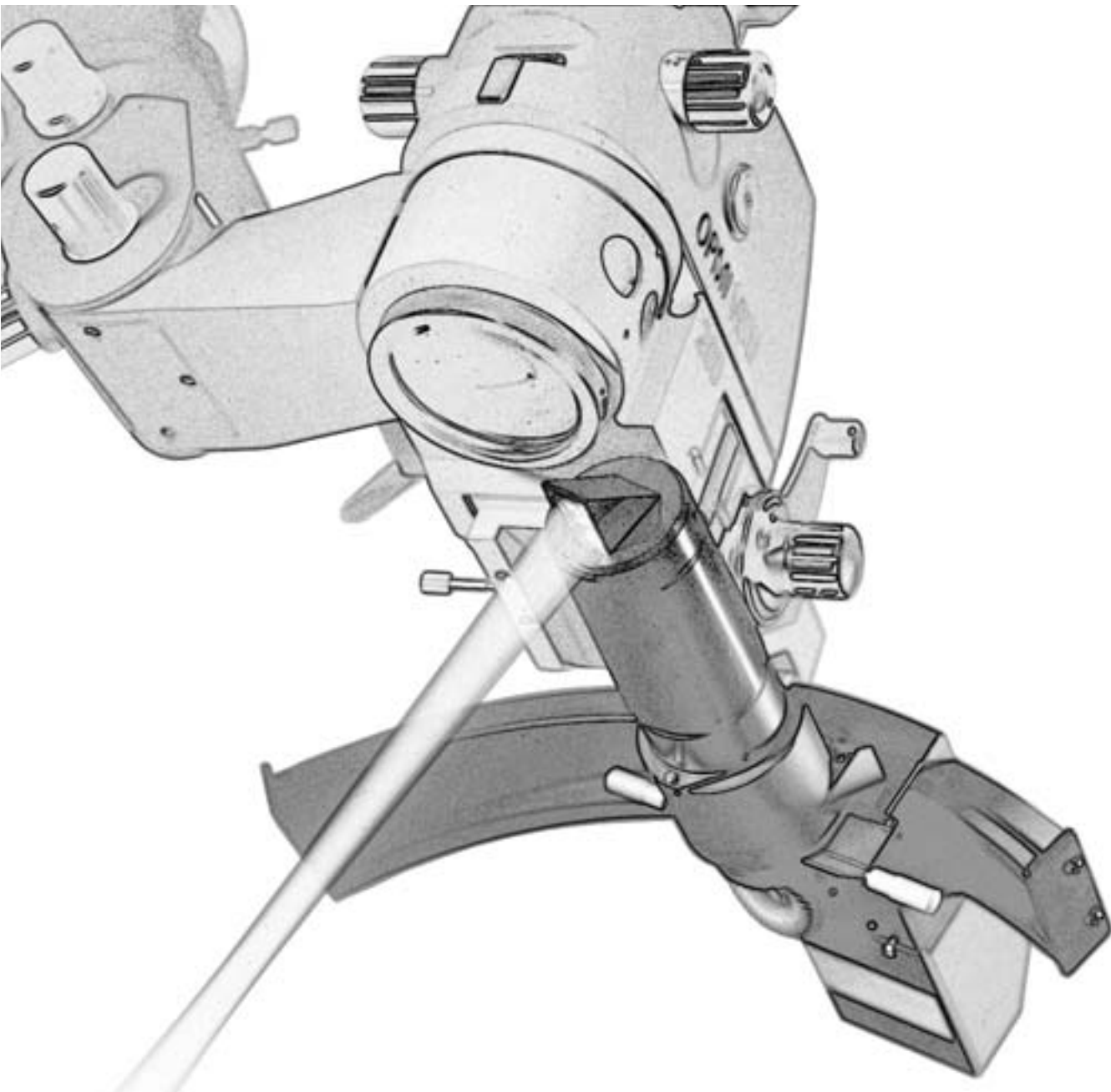


Usage of VISULUX™, a surgical slit illuminator



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We make it visible.

Usage of VISULUX™, a surgical slit illuminator

Kazuo Ichikawa and Tatsushi Kaga, Department of Ophthalmology, Social Insurance Chukyo Hospital

A surgical slit illuminator for use with the OPMI® VISU surgical microscope series is now available. During retinal and vitreous surgery, this illuminator can illuminate the inside of the eye better than conventional intraocular illumination devices. Moreover, it can provide high-contrast images. VISULUX™ has a wide range of applications, including mature cataract surgery, confirmation of the anterior chamber following corneal grafting, and glaucoma surgery. Dr. Kazuo Ichikawa and Dr. Tatsushi Kaga from the Department of Ophthalmology at the Social Insurance Chukyo Hospital have performed surgery using VISULUX™ on many patients and written an article about their experience.

Introduction

VISULUX™ is an adjunct surgical slit illuminator that can be used with Carl Zeiss' OPMI® VISU surgical microscope series. The idea of attaching a slit illuminator to a microscope has been previously reported¹⁻³). Although this type of device has been available in Japan, usage has significantly improved only in recent years.

Characteristics

Figure 1 shows the set-up for VISULUX™. The entire apparatus resembles a machine where a slit illuminator for slit lamp microscopes used in ambulatory medicine is attached to a surgical microscope used in operating rooms. The width of slit illumination can be adjusted to one of three options – 0.2 mm, 2 mm, or 3 mm – using the Slider (Figure 1: [1]). The angle of illumination can be adjusted freely within 30 degrees to both the left and right using the Arc guide (Figure 1: [2]). While the position of the slit illuminator can be adjusted manually using the Manual Activator (Figure 1: [3]), it can also be easily adjusted using the foot pedal. It is possible to obtain various high-contrast images during surgery by adjusting the width and angle of slit illumination. Although slit illumination can be combined with microscope illumination, better contrast can be achieved when only slit illumination is used.

Usage

VISULUX™ has a wide range of applications when put in the context of usage of slit lamp microscopes in ambulatory medicine. Moreover, it makes microscope illumination possible in situations previously unthinkable.

Observation and surgery, however, are two different matters. When performing surgery using only slit illumination, it is necessary to place a target object within a narrow range of slit illumina-

tion. This requires constant adjustment of the microscope in the X and Y directions. Furthermore, it is almost impossible to perform surgery with 0.2-mm slit illumination. As a result, surgery must be performed with either 2- or 3-mm slit illumination. When performing surgery over a large area, if the area of surgery goes beyond the range of slit illumination, X and Y adjustments are needed; however, adjustment can lag behind surgical movements in some cases. Also, when the eyeball moves, the target area disappears from the range of slit illumination, necessitating that surgery be performed while minimizing eye movements. When slit illumination is combined with either microscope or light-guide illumination, the degree of contrast is lower but the field of vision can be broadened, thus allowing the area of surgery to always remain illuminated. To achieve high contrast of the target object, it is wise to turn off microscope illumination when appropriate.

In the section below, the use of VISULUX™ in cataract, retinal, and vitreous surgery is described.

Cataract

For mature cataracts with a nuclear hardness of V, it is often difficult to see the edge of the anterior capsule when performing CCC in cases where direct illumination cannot be achieved. In such a case, slit illumination makes it easy to grab the end of the anterior capsule to complete CCC (Figure 2). Also, slit illumination is useful when the presence of the posterior capsule is dubious.

While it is often difficult to observe with microscope illumination the vitreous body during posterior capsule rupture in cataract surgery, such observation can be accomplished easily using slit illumination, which can also facilitate safe removal. It is sometimes necessary to check quickly the fundus in the following situations: when deciding whether or not to insert an intraocular lens after

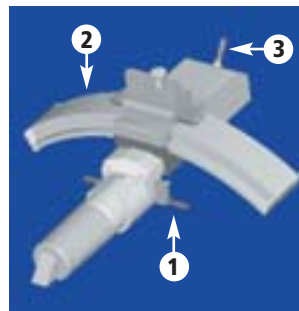


Figure 1



Figure 2

confirming the presence or absence of ocular fundus abnormality; in cases where the fundus cannot be observed prior to cataract surgery; or when confirming the presence or absence of residual lens during posterior capsule rupture in cataract surgery. With slit illumination, the fundus can be easily and conveniently observed by simply placing a vitreous contact lens on the cornea without using an indirect ophthalmoscope

Vitreous body and retina

The anterior region of the eye can be observed by allowing slit illumination to directly enter the region through the cornea. With microscope illumination, light may be reflected by the cornea, a cataract, or the intraocular lens, thus making it difficult to observe posterior objects. With slit illumination, however, high contrast images of these objects can be obtained. In particular, slit illumination allows remarkably clear observation of the vitreous body, which cannot be easily observed using microscope illumination.

By allowing slit illumination to pass through a non-contact aspheric lens, Goldman three-mirror lens, or vitreous contact lens, the posterior region of the eye can be observed (including the fundus and the vitreous body).

When observing the posterior region of the eye, it is necessary for doctors to confirm visually that slit illumination passes through the pupil and reflected light is captured. As a result, observation of the posterior region of the eye is difficult when the pupil is contracted or the capsule to which an intraocular lens is inserted is turbid or contracted.

Because slit illumination is reflected on the surface of a lens, it is necessary to prevent reflected light from entering the field of vision when observing the fundus. Although most easily observed when using a vitreous contact lens, the degree of fundus examination can vary among the different lenses. A lens with high refraction, a large optic region, and low surface reflection is useful. When the eyeball tilts, the fundus may not be observed if incoming light cannot enter the eye or if light reflected by the fundus is lost. As a result, caution should be exercised to minimize eyeball movement.

The usefulness of surgery using slit illumination varies at the anterior and posterior regions of the eye. In the anterior region, surgery is often performed by utilizing the advantages associated with slit illumination. In contrast, in the posterior region, because light-guide illumination can be used, slit illumination is rarely used alone. Since light-guide illumination can be directly applied to the inside of the eye, incoming light is not affected by the cornea, iris, cataract, or intraocular lens. Also, even when the eyeball tilts, incoming light is unaffected and, as a result, surgery can be performed without being too concerned about eyeball movement. However, when surgery is done using slit illumination, it is necessary to constantly ensure that incoming light enters the eye. Moreover, it is equally important to adjust the microscope in the X and Y directions in connection with the movement of the target

object to ensure that the target object is within the range of slit illumination. Therefore, instead of performing surgery using only slit illumination, it may be more practical to combine slit illumination and light-guide illumination.

The section below lists surgical procedures where VISULUX™ is highly useful.

1) Cutting a peripheral vitreous without vitrectomy lens

This is a highly useful application of VISULUX™. Although the vitreous body can be observed using microscope illumination, it can be observed much better using slit illumination. With slit illumination, it is possible to closely observe areas of the vitreous body that are too deep for microscope illumination. Moreover, it is also possible to ascertain both the location of posterior vitreous detachment and the base of the vitreous body (especially incarcerated vitreous body at the scleral incision), in the form of optical sections. Figure 3 shows a picture of the vitreous body examined using only slit illumination. While observing the peripheral vitreous body using microscope illumination is difficult for interns, with experience, more information can be drawn. On the other hand, both interns and skilled doctors can use slit illumination with similar degrees of effectiveness to observe the vitreous body. VISULUX™ is a very effective tool for doctors willing to learn vitreous surgery.

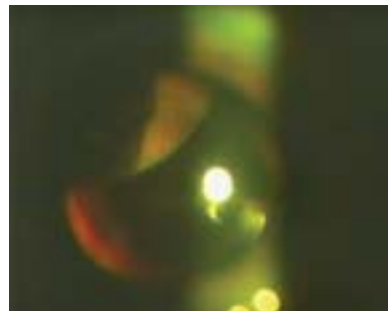


Figure 3

From the surgeon's viewpoint, the left side of the vitreous body can be easily observed by placing slit illumination to the right. Conversely, the right side of the vitreous body can easily be observed by placing slit illumination to the left. When only slit illumination is used, the field of vision is narrow. In turn, by combining it with microscope illumination, the site of vitrectomy is markedly moved, broadening the field of vision and making the surgery more efficient.

2) Confirmation and aspiration of residual liquid perfluorocarbon

While it is not easy to observe liquid perfluorocarbon on the retina using light-guide illumination, this can easily be done using slit illumination. With slit illumination, perfluorocarbon can easily be aspirated. Hence, VISULUX™ is highly useful in this application.

3) Scleral buckling for retinal detachment

With a Goldman three-mirror lens (or the like), details of the fundus can easily be observed, and retinal tears can be examined under magnification. In addition, with a Goldman three-mirror lens, retinal cryocoagulation is possible. This type of procedure, however, is difficult due to shifting of a contact lens or contacts between a cryocoagulation probe and the contact lens. If scleral compression can be done more easily using such measures as making the probe smaller, its indication will be broader. It is inconvenient to perform surgery using a microscope and a binocular indirect ophthalmoscope. Hence, it is more convenient if surgery can be performed using only a microscope. If retinal photocoagulation can be performed microscopically, a new surgical method, where a laser is used during scleral compression or immediately after buckle suturing, can be established.

Observation of the fundus after buckle suturing is very convenient because there is no need to look through a binocular indirect ophthalmoscope.

4) Retinal membrane, anterior membrane, and inner limiting membrane

Although the field of vision is narrower with slit illumination, contrast is better than light-guide illumination, thus making it easier to observe these membranes.

However, when surgically manipulating these membranes, large movements cannot be made due to the narrowness of the field of vision. As a result, surgical movements are slightly more restricted. Therefore, this type of surgery should be performed in combination with light-guide illumination. However, light-guide illumination may not be required if visibility is improved by applying Kenacort to the retinal surface, vitreous membrane, or proliferative membrane.

5) Neovascular extraction

The extent and height of serous retinal detachment can be observed. As a result, the accuracy of neovascular extraction can be improved.

6) Bimanual technique for vitreous surgery

Because there is no need to use a light guide to illuminate the fundus, bimanual technique surgery can be performed using regular vitreous equipment without any special equipment. However, slit illumination always needs to be passed through the pupil to

reach the target object, and then reflected light needs to be captured using the two eyes. Consequently, it is necessary to operate equipment with both hands while avoiding moving the eyeball. This procedure requires some training and skill.

Conclusions

Due to space limitations, all the benefits of VISULUX™ cannot be mentioned here. Put simply, however, because VISULUX™ can be used to observe corneal grafts during corneal grafting, assess the anterior chamber after grafting, and observe the chamber angle during glaucoma surgery, it lends itself to a variety of applications in ophthalmological surgery.

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2) *Primbs GB: Slit-lamp biomicroscope for operating room use. Trans Am Acad Ophthalmol Otolaryngol. 1975 Mar-Apr; 79(2): OP427*

3) *Peyman GA. Slit-lamp operating microscope In; Irvine AR, O'Malley C, ed. Advances in vitreous surgery. 1976*



Carl Zeiss

Surgical Products Division
73446 Oberkochen
Germany
Fax: ++49/73 64 20-48 23
Email: surgical@zeiss.de
www.zeiss.com/eye