

# Treatment of HSV Epithelial Keratitis After LASIK Surgery

To watch a video of this case, visit [Eyetube.net](http://Eyetube.net) and enter the keyword "Zirgan" in the search bar.

BY MILE BRUJIC, OD



A 58-year-old white male presented to my office reporting discomfort, foreign body sensation, and blurred vision in the right eye 3 months after having undergone LASIK surgery. The eye's UCVA was 20/70, and when I examined the anterior segment, I found mild-to-moderate corneal edema and an ulcer with the classic appearance of a dendrite. The clinical picture was highly consistent with herpes simplex keratitis. This article describes my use of ZIRGAN (ganciclovir ophthalmic gel) 0.15% (Bausch + Lomb; Rochester, NY), which is a topical ophthalmic antiviral gel indicated for the treatment of acute herpetic keratitis (dendritic ulcers).

I prescribed the patient one drop of ZIRGAN five times per day and requested to see him 3 days later. When the patient returned, his foreign body sensation had subsided, and his visual acuity had significantly improved to 20/30. I asked him to continue instilling one drop of ZIRGAN five times per day for 4 more days. After 7 days of treatment, his corneal ulcer had completely healed. I instructed him to continue applying one drop of ZIRGAN three times per day for the next 7 days. At his final visit, this patient showed complete clinical resolution of the HSV epithelial keratitis.

## TREATMENT OPTIONS

Whenever we encounter ocular issues, and infection in particular, we always favor treating them with topical agents versus oral, because the systemic side-effect profile of the former is generally better. We must be particularly careful when administering oral antivirals to patients with renal insufficiency or disease, as these medications may be more likely to cause side effects in these cases.

Before ZIRGAN gel was available, my standard protocol for treating HSV epithelial keratitis was to prescribe Viroptic drops (Monarch Pharmaceuticals, Inc., Bristol, TN) every 2 hours while the patient was awake until the ulcer resolved, and then have the patient continue using Viroptic every 4 hours for an additional 7 days. I now choose ZIRGAN, which has a dosing schedule of one drop administered five times per day until the corneal ulcer heals, and then 1 drop three times per day for 7 days thereafter. Furthermore, ZIRGAN does not require refrigeration. In addition, thimerosal, the preservative in Viroptic, has previously been associated with irritation for some patients.

Ganciclovir, the active molecule in ZIRGAN, is interesting because it is able to selectively target virally infected cells and prevent them from replicating. Thus, very little of the



**Figure 1.** A corneal ulcer that presented after LASIK surgery completely healed after 7 days of treatment with ZIRGAN gel 0.15%. Individual results may vary. In clinical trials, resolution (healed ulcers) at day 7 was achieved in 72% (41 of 57) to 77% (55 of 71) of patients with dendritic ulcers.

active drug is introduced to the surrounding healthy corneal cells, a fact that can minimize toxicity. Activated ganciclovir inhibits viral DNA in two ways. First, it uses competitive inhibition to directly inhibit viral DNA polymerase and prevent viral replication. Second, ganciclovir incorporates itself into the viral DNA, resulting in chain termination and thereby preventing DNA synthesis.

For acute herpetic keratitis, ZIRGAN 0.15% gel has become my first choice when treating patients.

## IMPORTANT RISK INFORMATION

ZIRGAN is indicated for topical ophthalmic use only. Patients should not wear contact lenses if they have signs or symptoms of herpetic keratitis or during the course of therapy with ZIRGAN. The most common adverse reactions reported in patients were blurred vision (60%), eye irritation (20%), punctate keratitis (5%), and conjunctival hyperemia (5%).

**See the brief summary of the ZIRGAN full prescribing information on the following page.**

*Mile Brujic, OD, is an optometrist and partner at Premier Vision Group in Bowling Green, Ohio, who specializes in contact lenses and disease management of the anterior segment and glaucoma. He is on the editorial board of Optometry Times and lectures internationally. He acknowledged no financial interest in the product or company described herein. Dr. Brujic may be reached at (419) 352-2502; [brujic@prodigy.net](mailto:brujic@prodigy.net).*

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# Zirgan<sup>®</sup>

## ganciclovir ophthalmic gel 0.15%

### HIGHLIGHTS OF PRESCRIBING INFORMATION

These highlights do not include all of the information needed to use ZIRGAN<sup>®</sup> safely and effectively.

See full prescribing information for ZIRGAN.

ZIRGAN (ganciclovir ophthalmic gel) 0.15%

Initial U.S. approval: 1989

### INDICATIONS AND USAGE

ZIRGAN is a topical ophthalmic antiviral that is indicated for the treatment of acute herpetic keratitis (dendritic ulcers). (1)

### DOSAGE AND ADMINISTRATION

The recommended dosing regimen for ZIRGAN is 1 drop in the affected eye 5 times per day (approximately every 3 hours while awake) until the corneal ulcer heals, and then 1 drop 3 times per day for 7 days. (2)

### DOSAGE FORMS AND STRENGTHS

ZIRGAN contains 0.15% of ganciclovir in a sterile preserved topical ophthalmic gel. (3)

### FULL PRESCRIBING INFORMATION: CONTENTS\*

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### FULL PRESCRIBING INFORMATION

#### 1 INDICATIONS AND USAGE

ZIRGAN (ganciclovir ophthalmic gel) 0.15% is indicated for the treatment of acute herpetic keratitis (dendritic ulcers).

#### 2 DOSAGE AND ADMINISTRATION

The recommended dosing regimen for ZIRGAN is 1 drop in the affected eye 5 times per day (approximately every 3 hours while awake) until the corneal ulcer heals, and then 1 drop 3 times per day for 7 days.

#### 3 DOSAGE FORMS AND STRENGTHS

ZIRGAN contains 0.15% of ganciclovir in a sterile preserved topical ophthalmic gel.

#### 4 CONTRAINDICATIONS

None.

#### 5 WARNINGS AND PRECAUTIONS

##### 5.1 Topical Ophthalmic Use Only

ZIRGAN is indicated for topical ophthalmic use only.

##### 5.2 Avoidance of Contact Lenses

Patients should not wear contact lenses if they have signs or symptoms of herpetic keratitis or during the course of therapy with ZIRGAN.

#### 6 ADVERSE REACTIONS

Most common adverse reactions reported in patients were blurred vision (60%), eye irritation (20%), punctate keratitis (5%), and conjunctival hyperemia (5%).

#### 8 USE IN SPECIFIC POPULATIONS

##### 8.1 Pregnancy: Teratogenic Effects

Pregnancy Category C. Ganciclovir has been shown to be embryotoxic in rabbits and mice following intravenous administration and teratogenic in rabbits. Fetal resorptions were present in at least 85% of rabbits and mice administered 60 mg/kg/day and 108 mg/kg/day (approximately 10,000x and 17,000x the human ocular dose of 6.25 mcg/kg/day), respectively, assuming complete absorption. Effects observed in rabbits included: fetal growth retardation, embryolethality, teratogenicity, and/or maternal toxicity. Teratogenic changes included cleft palate, anophthalmia/microphthalmia, aplastic organs (kidney and pancreas), hydrocephaly, and brachygnathia. In mice, effects observed were maternal/fetal toxicity and embryolethality. Daily intravenous doses of 90 mg/kg/day (14,000x the human ocular dose) administered to female mice prior to mating, during gestation, and during lactation caused hypoplasia of the testes and seminal vesicles in the month-old male offspring, as well as pathologic changes in the nonglandular region of the stomach (see Carcinogenesis, Mutagenesis, and Impairment of Fertility).

There are no adequate and well-controlled studies in pregnant women. ZIRGAN should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus.

##### 8.3 Nursing Mothers

It is not known whether topical ophthalmic ganciclovir administration could result in sufficient systemic absorption to produce detectable quantities in breast milk. Caution should be exercised when ZIRGAN is administered to nursing mothers.

##### 8.4 Pediatric Use

Safety and efficacy in pediatric patients below the age of 2 years have not been established.

##### 8.5 Geriatric Use

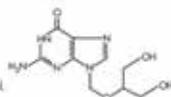
No overall differences in safety or effectiveness have been observed between elderly and younger patients.

#### 11 DESCRIPTION

ZIRGAN (ganciclovir ophthalmic gel) 0.15% contains a sterile, topical antiviral for ophthalmic use. The chemical name is 9-[[2-hydroxy-1-(hydroxymethyl)ethoxy)methyl]guanine (CAS number 82410-32-0). Ganciclovir is represented by the following structural formula:

Ganciclovir has a molecular weight of 255.23, and the empirical formula is C<sub>8</sub>H<sub>12</sub>N<sub>4</sub>O<sub>5</sub>.

Each gram of gel contains: ACTIVE: ganciclovir 1.5 mg (0.15%). INACTIVES: carbopol, water for injection, sodium hydroxide (to adjust the pH to 7.4), mannitol. PRESERVATIVE: benzalkonium chloride 0.075 mg.



### CONTRAINDICATIONS

None.

### WARNINGS AND PRECAUTIONS

- ZIRGAN is indicated for topical ophthalmic use only. (5.1)
- Patients should not wear contact lenses if they have signs or symptoms of herpetic keratitis or during the course of therapy with ZIRGAN. (5.2)

### ADVERSE REACTIONS

Most common adverse reactions reported in patients were blurred vision (60%), eye irritation (20%), punctate keratitis (5%), and conjunctival hyperemia (5%). (6)

To report SUSPECTED ADVERSE REACTIONS, contact Bausch & Lomb at 1-800-323-0000 or FDA at 1-800-FDA-1088 or www.fda.gov/medwatch.

See 17 for PATIENT COUNSELING INFORMATION.

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#### 8.5 Geriatric Use

#### 11 DESCRIPTION

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\*Sections or subsections omitted from the full prescribing information are not listed.

#### 12 CLINICAL PHARMACOLOGY

##### 12.1 Mechanism of Action

ZIRGAN (ganciclovir ophthalmic gel) 0.15% contains the active ingredient, ganciclovir, which is a guanosine derivative that, upon phosphorylation, inhibits DNA replication by herpes simplex viruses (HSV). Ganciclovir is transformed by viral and cellular thymidine kinases (TK) to ganciclovir triphosphate, which works as an antiviral agent by inhibiting the synthesis of viral DNA in 2 ways: competitive inhibition of viral DNA-polymerase and direct incorporation into viral primer strand DNA, resulting in DNA chain termination and prevention of replication.

##### 12.3 Pharmacokinetics

The estimated maximum daily dose of ganciclovir administered as 1 drop, 5 times per day is 0.375 mg. Compared to maintenance doses of systemically administered ganciclovir of 900 mg (oral valganciclovir) and 5 mg/kg (IV ganciclovir), the ophthalmically administered daily dose is approximately 0.04% and 0.1% of the oral dose and IV doses, respectively, thus minimal systemic exposure is expected.

#### 13 NONCLINICAL TOXICOLOGY

##### 13.1 Carcinogenesis, Mutagenesis, and Impairment of Fertility

Ganciclovir was carcinogenic in the mouse at oral doses of 20 and 1,000 mg/kg/day (approximately 3,000x and 160,000x the human ocular dose of 6.25 mcg/kg/day, assuming complete absorption). At the dose of 1,000 mg/kg/day there was a significant increase in the incidence of tumors of the preputial gland in males, forestomach (nonglandular mucosa) in males and females, and reproductive tissues (ovaries, uterus, mammary gland, clitoral gland, and vagina) and liver in females. At the dose of 20 mg/kg/day, a slightly increased incidence of tumors was noted in the preputial and harderian glands in males, forestomach in males and females, and liver in females. No carcinogenic effect was observed in mice administered ganciclovir at 1 mg/kg/day (160x the human ocular dose). Except for histocytic sarcoma of the liver, ganciclovir-induced tumors were generally of epithelial or vascular origin. Although the preputial and clitoral glands, forestomach and harderian glands of mice do not have human counterparts, ganciclovir should be considered a potential carcinogen in humans. Ganciclovir increased mutations in mouse lymphoma cells and DNA damage in human lymphocytes in vitro at concentrations between 50 to 500 and 250 to 2,000 mcg/mL, respectively.

In the mouse micronucleus assay, ganciclovir was clastogenic at doses of 150 and 500 mg/kg (IV) (24,000x to 80,000x human ocular dose) but not 50 mg/kg (8,000x human ocular dose). Ganciclovir was not mutagenic in the Ames Salmonella assay at concentrations of 500 to 5,000 mcg/mL.

Ganciclovir caused decreased mating behavior, decreased fertility, and an increased incidence of embryolethality in female mice following intravenous doses of 90 mg/kg/day (approximately 14,000x the human ocular dose of 6.25 mcg/kg/day). Ganciclovir caused decreased fertility in male mice and hypopermatogenesis in mice and dogs following daily oral or intravenous administration of doses ranging from 0.2 to 10 mg/kg (30x to 1,600x the human ocular dose).

#### 14 CLINICAL STUDIES

In one open-label, randomized, controlled, multicenter clinical trial which enrolled 164 patients with herpetic keratitis, ZIRGAN was non-inferior to acyclovir ophthalmic ointment, 3% in patients with dendritic ulcers. Clinical resolution (healed ulcers) at Day 7 was achieved in 77% (55/71) for ZIRGAN versus 72% (48/67) for acyclovir 3% (difference 5.8%, 95% CI - 9.6%-18.3%). In three randomized, single-masked, controlled, multicenter clinical trials which enrolled 213 total patients, ZIRGAN was non-inferior to acyclovir ophthalmic ointment 3% in patients with dendritic ulcers. Clinical resolution at Day 7 was achieved in 72% (41/57) for ZIRGAN versus 69% (34/49) for acyclovir (difference 2.5%, 95% CI - 15.6%-20.9%).

#### 16 HOW SUPPLIED/STORAGE AND HANDLING

ZIRGAN is supplied as 5 grams of a sterile, preserved, clear, colorless, topical ophthalmic gel containing 0.15% of ganciclovir in a polycoated aluminum tube with a white polyethylene tip and cap and protective band (NDC 24208-535-35).

#### Storage

Store at 15°C-25°C (59°F-77°F). Do not freeze.

#### 17 PATIENT COUNSELING INFORMATION

This product is sterile when packaged. Patients should be advised not to allow the dropper tip to touch any surface, as this may contaminate the gel. If pain develops, or if redness, itching, or inflammation becomes aggravated, the patient should be advised to consult a physician. Patients should be advised not to wear contact lenses when using ZIRGAN.

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