CORNEAL PHOTOTHERAPY

- TECHNICAL FEATURES
- INDICATION OF USE
- CLINICAL BENEFITS

Vision Engineering Italy

VISIOFLAVIN® VETUMK® EQUIRVIS®

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VISION ENGINEERING ITALY

Solutions to unmet needs in eye care

INNOVATION IN VETERINARY OPHTHALMOLOGY

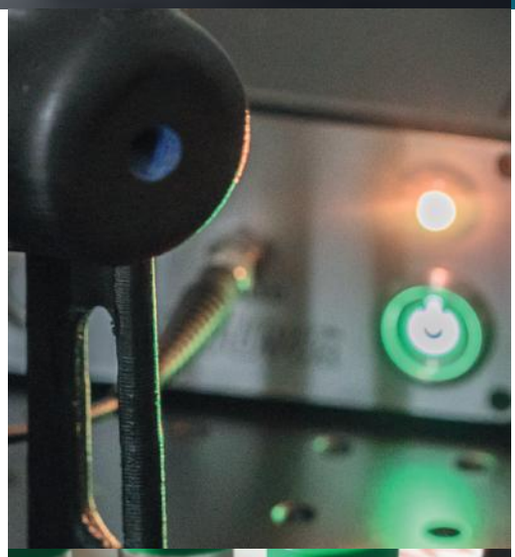
Corneal cross-linking for human use has been developed in Dresden (Germany) for treating KERATOCONUS in the late 1990s. Keratoconus is a vision threatening progressive degenerative corneal disease characterized by thinning and bulging of the cornea.

Corneal Cross-Linking (CXL) has been now well established as primary treatment option for keratoconus, avoiding corneal transplantation in most treated cases.

The CXL is a parasurgical treatment with "low invasiveness" and consists in "strengthening" the corneal tissue with the combined use of vitamin B2 (RIBOFLAVIN) and ultraviolet light rays (UV-A).

The CXL induces the generation of new chemical bonds between stromal proteins, thus increasing the tissue mechanical resistance to normal intraocular pressure, thus halting disease progression.

The treatment requires the application of riboflavin (Vitamin B2) before irradiating the cornea with UV-A.



Corneal phototherapy has been introduced in veterinary medicine by VISION ENGINEERING ITALY s.r.l.

Vision Engineering Italy srl is an innovative company in the Medtech sector. The Company develops new methods and systems for the prevention and treatment of eye diseases with significant socio-economic impact.

Thanks to the expertise in the field of CORNEAL CROSS-LINKING for human use, Vision Engineering Italy has introduced a new treatment paradigm of infectious keratitis and corneal ulcers in veterinary medicine: CORNEAL PHOTOTHERAPY.

CORNEAL PHOTOTHERAPY consists of irradiating the cornea with high UV-A power density, 30 mW/cm^2, after soaking the tissue with a riboflavin ophthalmic solution.

Unlike standard corneal cross-linking, which is generally performed with UV-A power densities ranging from 3 mW/cm^2 to 10 mW/cm^2, CORNEAL PHOTOTHERAPY induces a further microbicidal mechanism of action in the diseased cornea.

Dr. Marco Lombardo, eye surgeon, founder of Vision Engineering Italy

VISION ENGINEERING ITALY

Solutions to unmet needs in eye care

Vision Engineering Italy
has developed the first
UV-A medical device for the
CORNEAL PHOTOTHERAPY
of infectious keratitis and
corneal ulcers.
For veterinary use only.

VETUVIR®

The innovative UV-A
medical device

VISION
ENGINEERING
ITALY
Solutions to unmet needs in eye care

In a randomized controlled multicenter study, corneal phototherapy with VETUVIR® has been shown to be on average 80% more effective than topical antimicrobial therapies for the treatment of septic corneal ulcers in dogs and horses.

CORNEAL PHOTOTHERAPY

How does it work?

COMBINED USE OF:

VITAMIN B2 (RIBOFLAVIN):
10 minutes (EQUIRVIS)
20 minutes (VISIOFLAVIN)

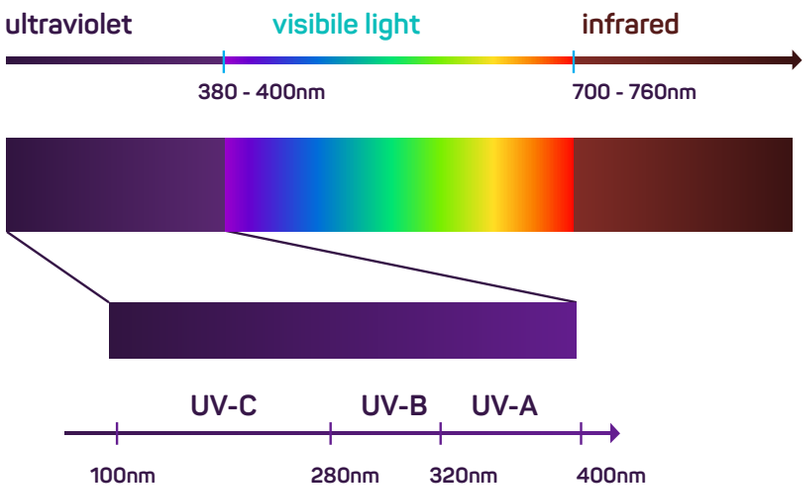
ULTRAVIOLET RAYS (UV-A):
3 minutes (30 mW/cm²)
9 minutes (10 mW/cm²)

DIRECT, NON SELECTIVE, MICROBICIDAL ACTION inducing PEROXIDATION of cell membranes of bacteria - viruses - fungi – protozoa

STRENGTHENING ACTION in the CORNEAL STROMA induced by PHOTO-POLYMERIZATION OF STROMAL PROTEINS, which contrasts the collagenolytic proteases' activity

CORNEAL PHOTOTHERAPY

Microbicide mechanism



• Ultraviolet light is an electromagnetic radiation with wavelengths shorter than visible light.

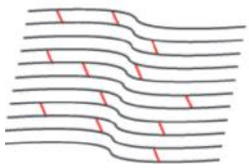
• In combination with photo-sensitizing substances, like riboflavin, UV-A radiation triggers photo-oxidative reactions that damage the cells.

• The photo-chemical action triggered by UV-A rays and the photo-sensitizing substance is instantaneous and acts directly onto the cellular components of microorganisms.

• No microorganism can resist to the photo-oxidative damage generated by UV-A rays and riboflavin. The corneal photo-therapy mechanism can virtually inactivate and kill all living microorganisms.

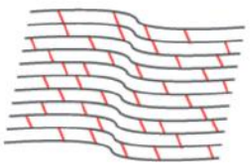
CORNEAL PHOTOTHERAPY

Cross-linking mechanism



Less cross-linking bonds:
weaker cornea

The "cross-links" are chemical bonds between corneal stromal proteins



More cross linking bonds:
stronger cornea

Main advantages of the mechanism of action of **corneal phototherapy** on infective agents compared to antimicrobial topical therapy:

- **Photo-chemical mechanism of action;**
- **Not selective;**
- **It does not induce resistance to antibiotics;**
- **Strengthens the corneal structure.**

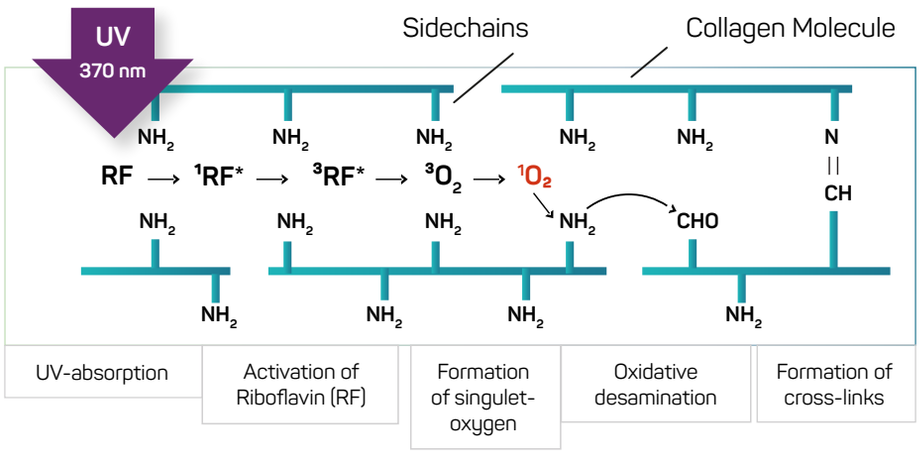
How does it work?

Corneal phototherapy consists in illuminating the cornea, after the tissue has been administered with a riboflavin ophthalmic, such as Visioflavin® or Equirvis®, using the Vetuvir® UV-A device.

1 - Administer riboflavin (Equirvis o Visioflavin)

2 - Illuminate the cornea with Vetuvir

Corneal phototerapy reaction



RF=riboflavin

Peroxidation of cell membranes

Direct bactericidal action on microbes caused by peroxidation of cell membranes.

Strengthening of the corneal stroma

Strengthens the biomechanics and microstructure of the corneal tissue by photo-polymerization of stromal proteins (which also counteracts the collagenolytic activity of bacteria).

The medical devices Vetuvir®, Visioflavin® and Equirvis® are for exclusive use in veterinary medicine. They are registered trademarks of Vision Engineering Italy srl.

VETUVIK®

Unique technical features

- Selectable light irradiance: 10 mW/cm², 30 mW/cm²
- Portable
- Ease of use
- Bluetooth remote control

Indications of use

- Corneal infection (30 mW/cm²)
- Corneal ulcer (30 mW/cm²)
- Bullous keratopathy (10 mW/cm²)

Advantages

- Rapid procedure (it takes a few minutes)
- Effective in monotherapy
- Superior to topical therapy for the treatment of corneal ulcers (RCT VEI_vet01)
- Does not induce antibiotic resistance

EQUIRVIS

Highly concentrated riboflavin ophthalmic solution

UNIQUE TECHNICAL FEATURES

- Riboflavin 0.22%
- Hypotonic
- Volume 3 ml
- High cost-benefit ratio

INDICATIONS FOR USE

- Corneal infection
- Corneal ulcer
- Bullous keratopath

ADVANTAGES

- Reduces the time of administration (10 min.)
- Further improves efficacy of corneal phototherapy
- Greater protection of the corneal tissue in case of deep ulcers

VISION ENGINEERING ITALY

Solutions to unmet needs in eye care

Innovation
in veterinary ophthalmology

Corneal phototherapy
Clinical cases

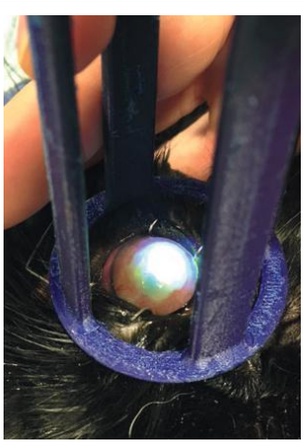
French Bulldog with corneal *melting* and descemetocele.
Resistant to antibiotic therapy.
Kind courtesy of Prof. C. Perruccio

1 day after treatment
(No more descemetocele)

2 weeks after treatment
(The cornea begins to become somewhat transparent)

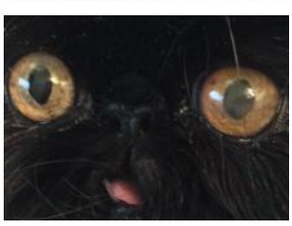
1 month after treatment
(Visual function is restored)

Persian cat with septic corneal *ulcer*.
Courtesy of Dr. C. Giordano



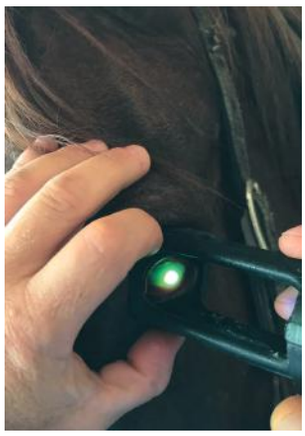
1 month after treatment
(Neovascularization)

2 months after treatment
(The cornea is almost completely transparent)



Corneal phototherapy
Clinical cases

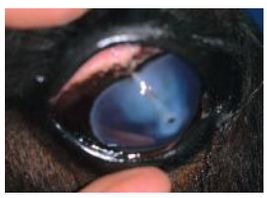
Horse with septic corneal abscess
(pseudomonas+ and streptococcus+).
Resistant to antibiotic therapy.
Kind courtesy of Prof. R. Gialletti



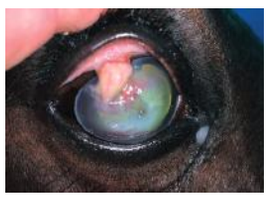
1 week after treatment with VETUVIR®
(almost complete resolution
of the abscess)

5 week after treatment with VETUVIR®
(pseudomonas- and streptococcus-)
The eye has recovered its visual function

It is never too late to treat a corneal ulcer with Vetuvir®



Deep ulcer in a horse treated with Ceftriazone based on the antibiogram.



Because of the quick worsening of the ulcer, the surgeon performed a conjunctival flap, which however could not restore vision.

Corneal phototherapy was performed with Vetuvir (30 mW/cm^2) and Visioflavin.

After 3 days from corneal phototherapy, new vessels and granulation tissue were capping the corneal ulcer.

9 days after corneal phototherapy, the corneal epithelium was intact and the neovascolarization begun to withdraw.

VETUVIK®

- Produced by Vision Engineering Italy research.
- Proprietary technology.
- Specific for veterinary medicine.
- Wide spectrum of efficacy: bacteria, fungi, viruses, protozoa.
- Non-selective mechanism of action that does not create antimicrobial resistance.
- Improves corneal tissue's integrity.
- Clinically proven: performance better than standard of care (studio clinico VEI_vet01).
- Save the eye.
- High quality: durable device.
- Simple to use.
- Easy compliance to therapy: effective with a single treatment.

From left to right: Dr. Sebastiano Serrao, Eng. Giuseppe Lombardo, Dr. Marco Lombardo. Giuseppe and Marco Lombardo are brothers and co-founders of Vision Engineering Italy srl

INNOVATION IN VETERINARY OPHTHALMOLOGY

"Solutions to unmet needs in eye care"

VISION ENGINEERING ITALY SRL

Innovative company in the *Medtech* sector

- Biomedical company specialized in research
- Focus on ophthalmology
- Made in Italy
- Compliant with the European regulatory and quality requirements
- Holds proprietary and patented technologies
- Has created products specifically for veterinary use
- Corneal phototherapy has been shown to be 80% more effective than standard topical antimicrobial therapy for the treatment of corneal ulcers and infectious keratitis (study VEI_vet01)[1,3]

VISION ENGINEERING ITALY

Solutions to unmet needs in eye care

CORNEAL PHOTOTHERAPY

effective and safe therapy of corneal infections

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