

PRELIMINARY OBSERVATIONS OF OCULAR SURFACE DISORDERS IN HORSES DIAGNOSED WITH KERATITIS AND EXAMINED WITH OSA-Vet

Alexia Cattaneo ^{1,3}, Claudio Peruccio ², Adolfo Guandalini ³

1 - Equine Ophthalmic Referrals, Albino, Italy

2 - Centro Veterinario Torinese, Ophthalmology Referrals, Torino, Italy

3 - Centro Veterinario Specialistico, Ophthalmology Referrals, Roma, Italy



PURPOSE

- Retrospective study
- Horses examined between February 2019 and December 2021 - Northern Italy (Lombardia, Piemonte, Liguria, Valle d'Aosta)
- Diagnosis: **keratitis**
- TF Interferometry with **Ocular Surface Analyser**, Veterinary setting (SBM[®], Turin, Italy)

METHODS

- Complete ophthalmic examination
 - sedation + auriculopalpebral nerve block
 - slit lamp biomicroscopy, tonometry, direct and indirect ophthalmoscopy
- Interferometry
- Vital staining
- Sampling



METHODS - TF Interferometry



Interferometry to evaluate tear film lipid layer thickness, dynamics and tear meniscus height.

@s.a.vet

Clinical Atlas

Ocular Surface Analyser, Veterinary Setting, for the Diagnosis of Dry Eye with O.S.A.-VET

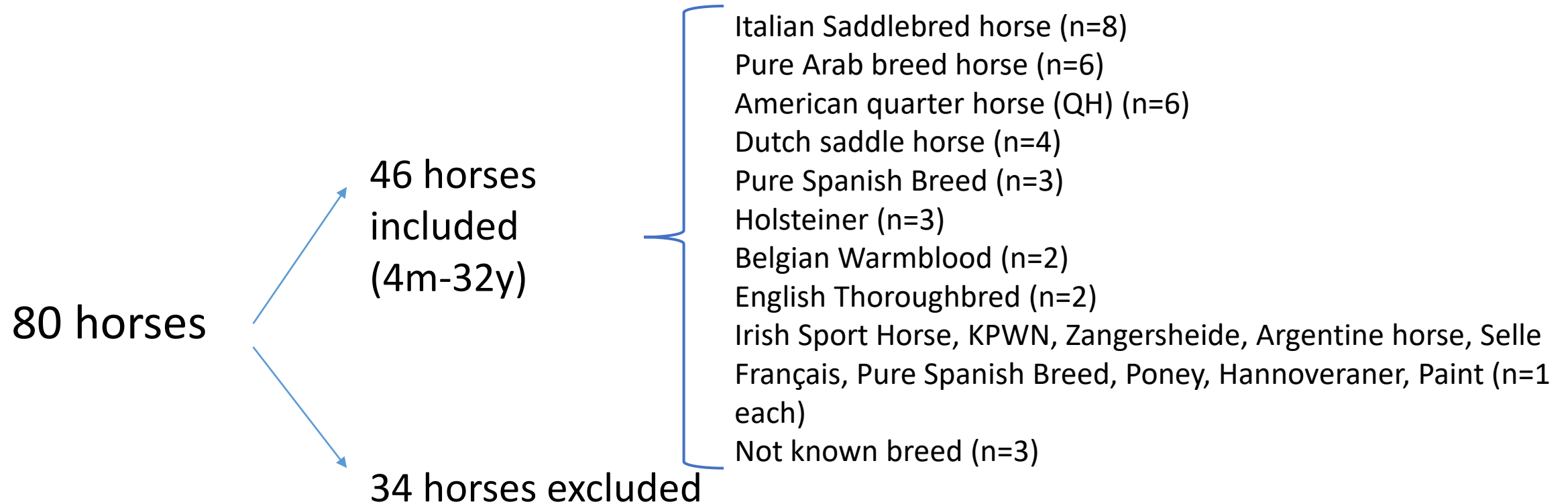
SBM
Sistemi

EDITOR
Claudio Peruccio

AUTHORS

AUSTRALIA Kelly Caruso Benjamin Reynolds Jeffrey Smith Cameron Whittaker	ITALY Elena Barbasso Alexia Caltaneo Francesca Corsi Nunzio D'Anna Adolfo Guandalini Claudio Peruccio Daniela Terlizzi Maria Vilas Portillo	MEXICO Gustavo A. Garcia Sánchez Halina Hernandez
GERMANY Ingrid Allgoewer	UK Robert O'Shiner Daniela Santillo	USA Federica Maggio Stefano Pizzirani
	JAPAN Hiroko Ineshita Akifumi Sato	

METHODS



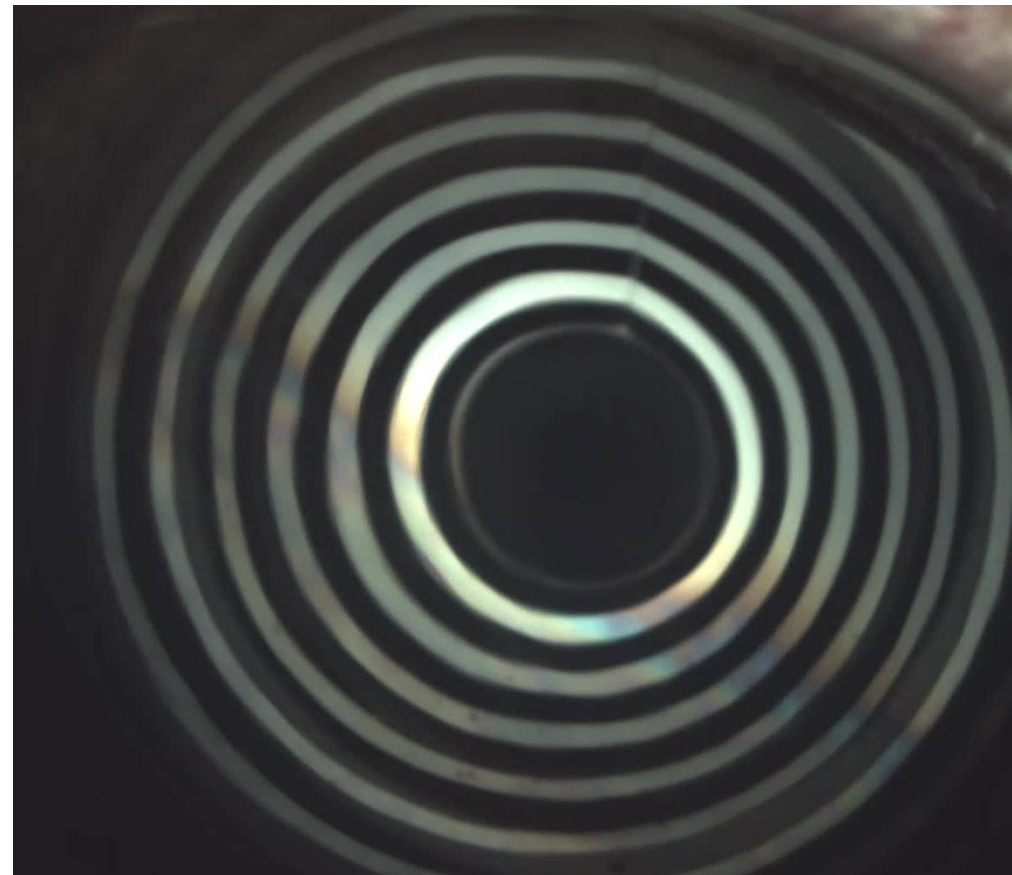
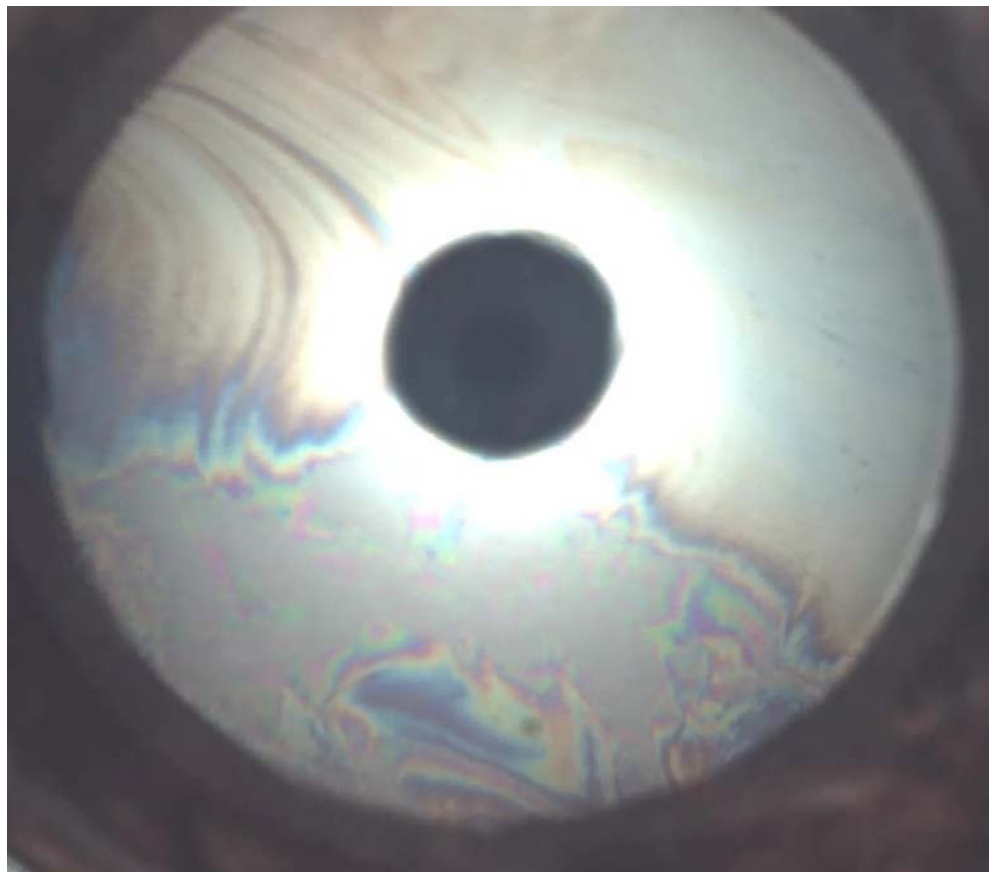
RESULTS

- Keratitis (n=46)
 - Infectious keratitis (one bacterial and the others affected by fungal disease) (n=14)
 - Non-infectious keratitis (n=32)- non infected corneal ulcers
 - SCCEDs
 - IMMK
 - corneal edema
- Diagnosis: clinical signs - laboratory results - response to treatment

RESULTS

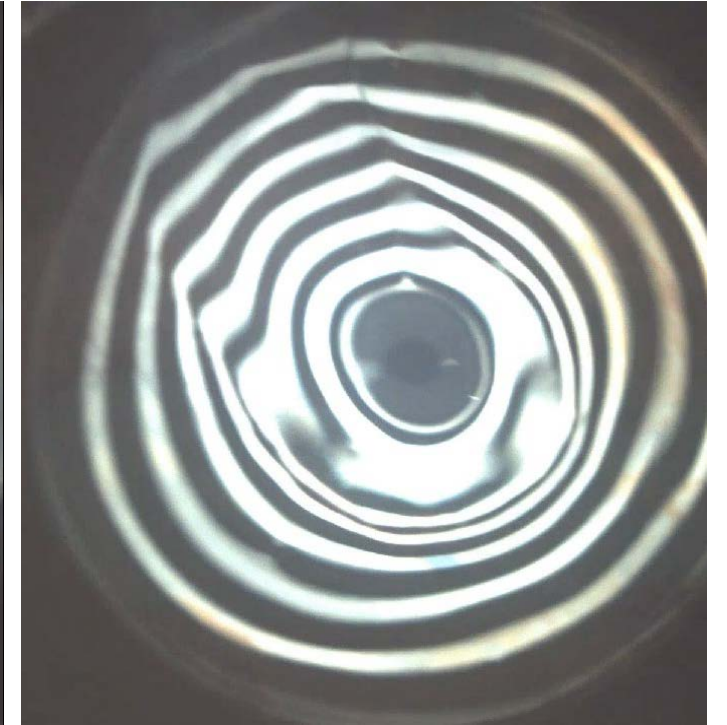
- Screenshots of videos taken during the examination
- Screenshots were taken immediately after blinking
- Dust can fall on the ocular surface mimicking a short BUT

RESULTS - normal eye



Holsteiner, F, 13 yo

RESULTS - non infected corneal ulcer



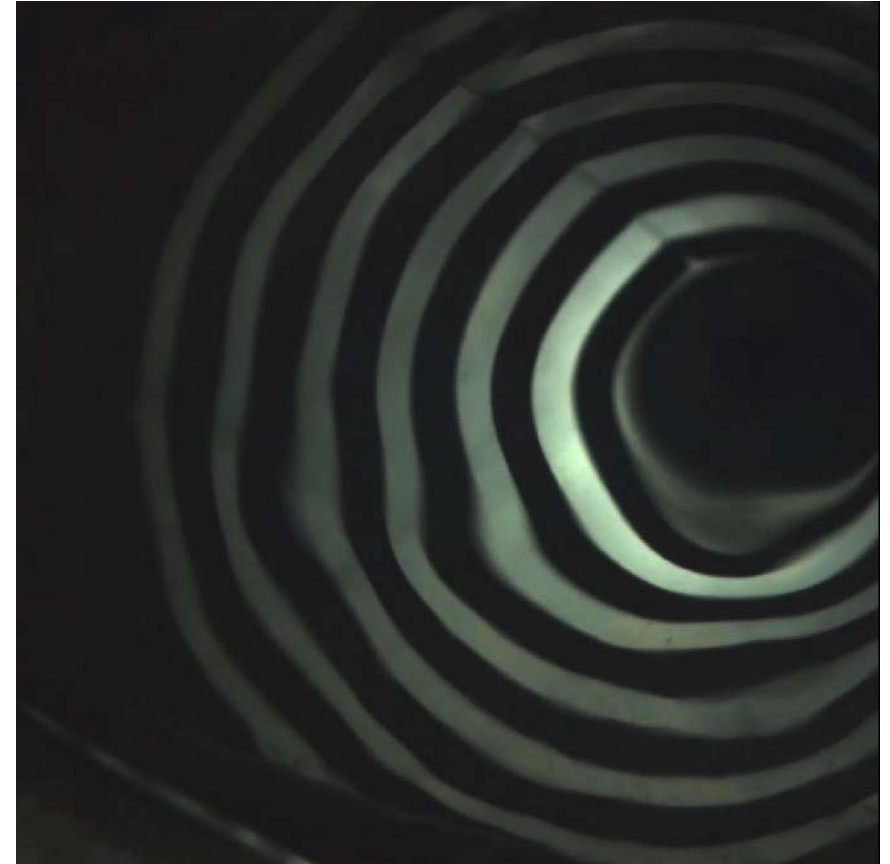
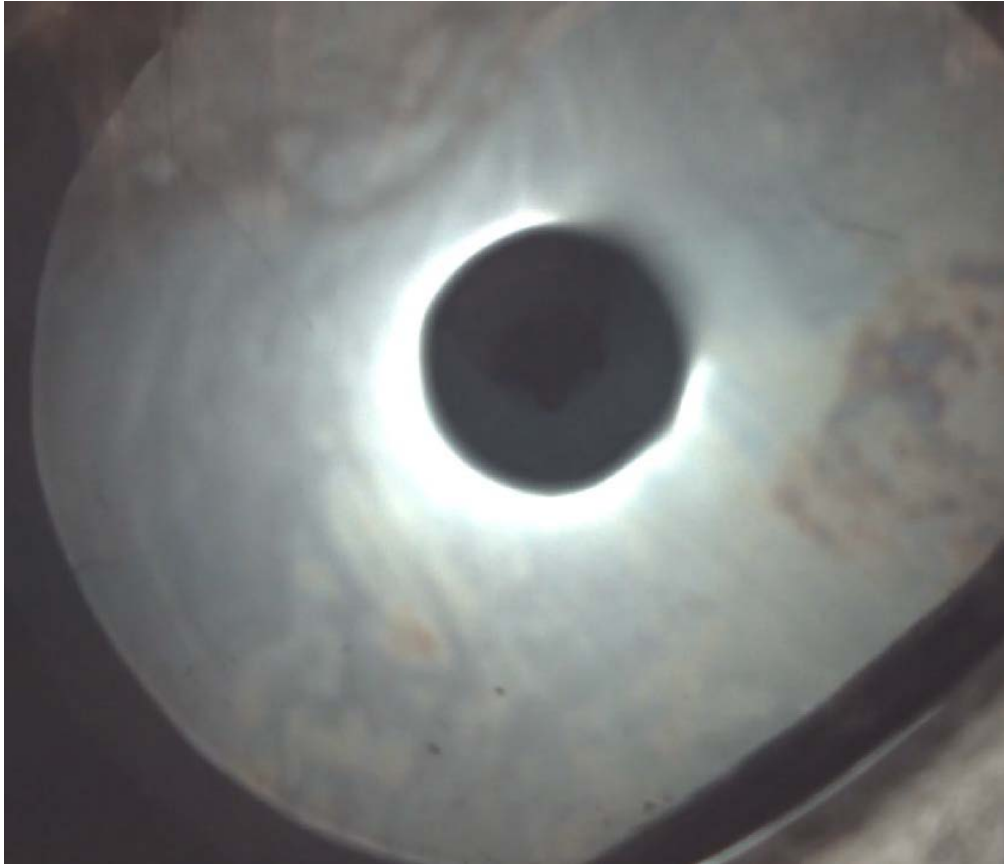
Pure Spanish Breed, F, 11 yo, OS

RESULTS - foreign body



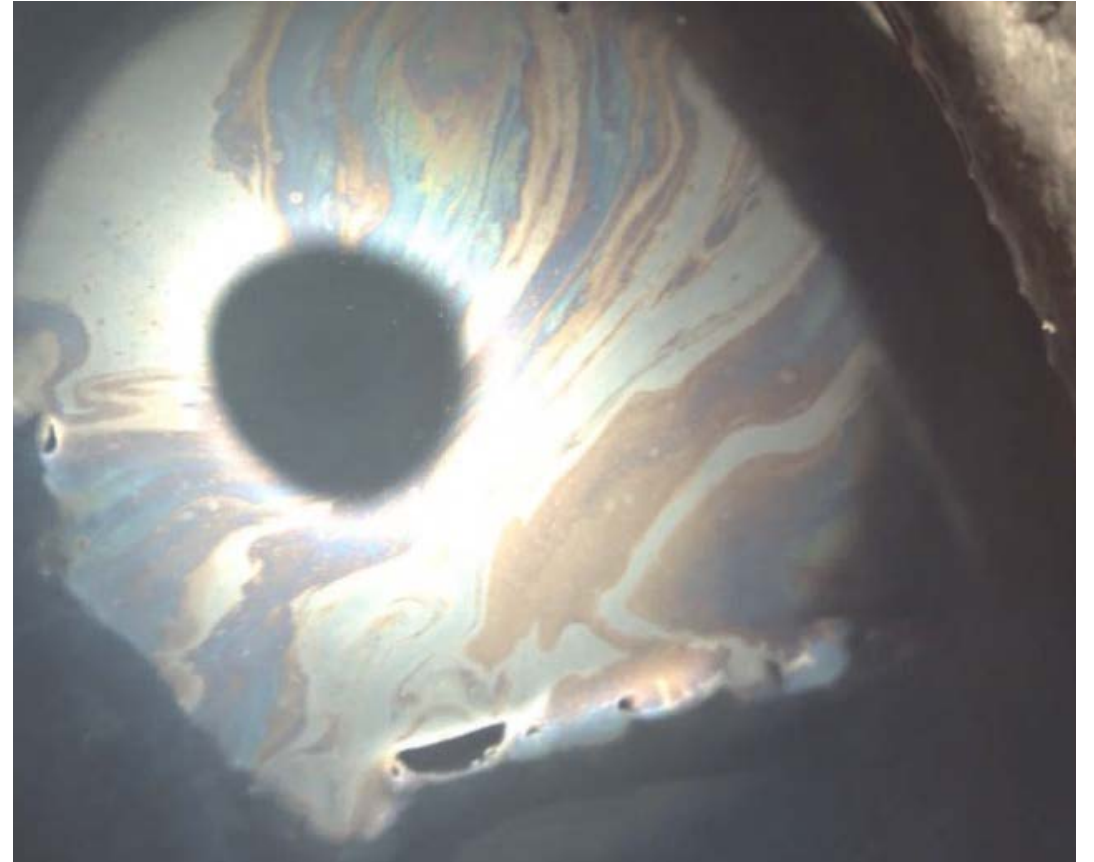
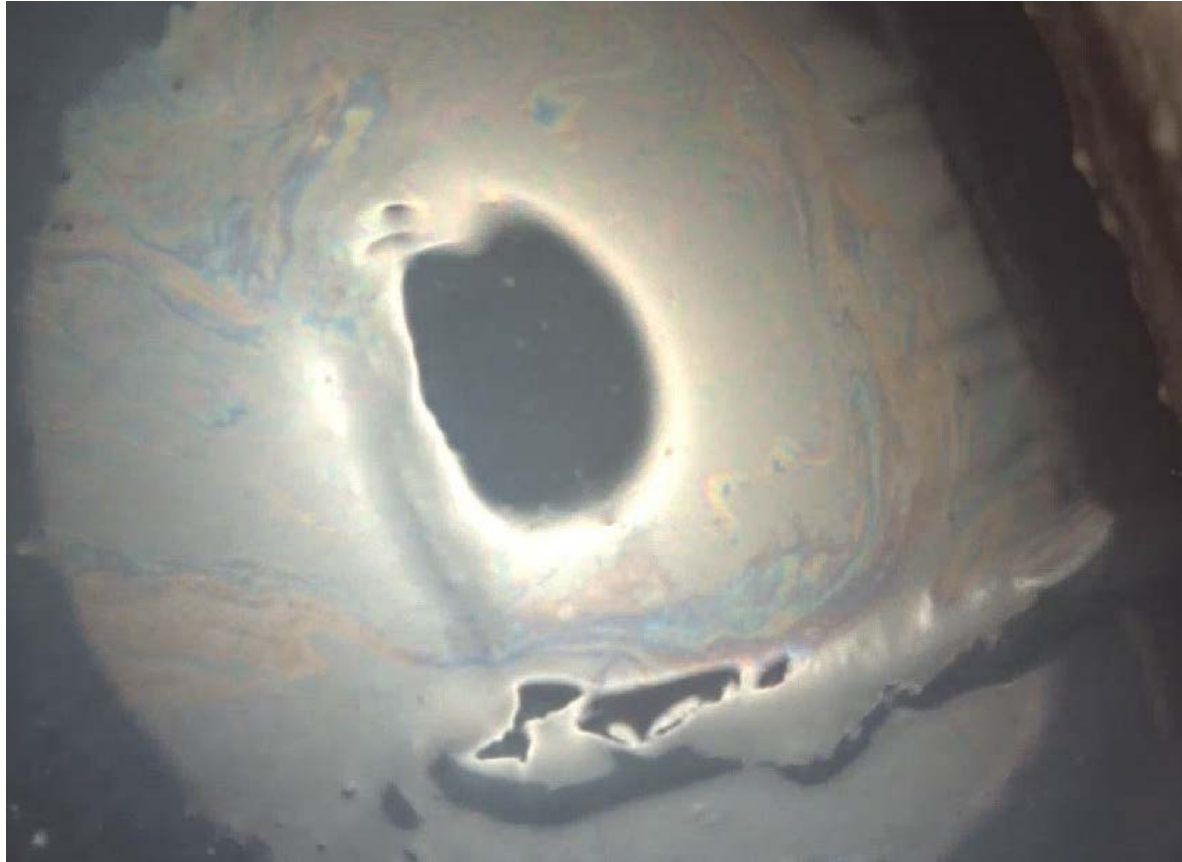
Irish Sport Horse, G, 9 yo, OD

RESULTS - qualitative alteration of the TF



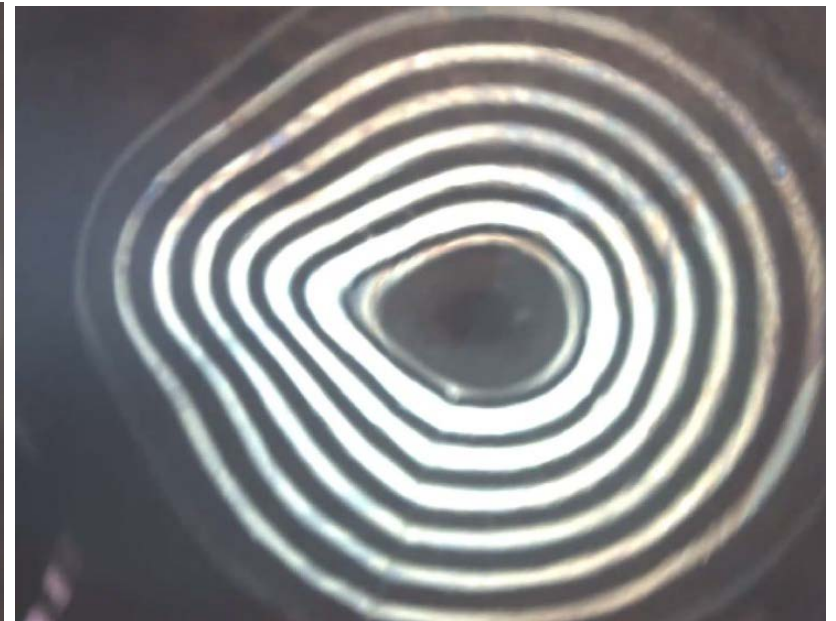
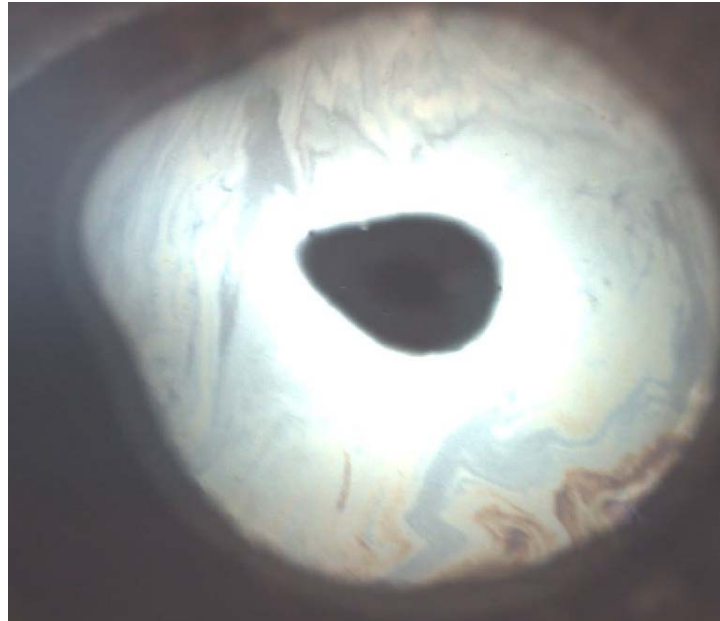
Pure Spanish Breed, G, 22 yo, OD (frequent blepharospasm episodes, short BUT)

RESULTS - SCCED



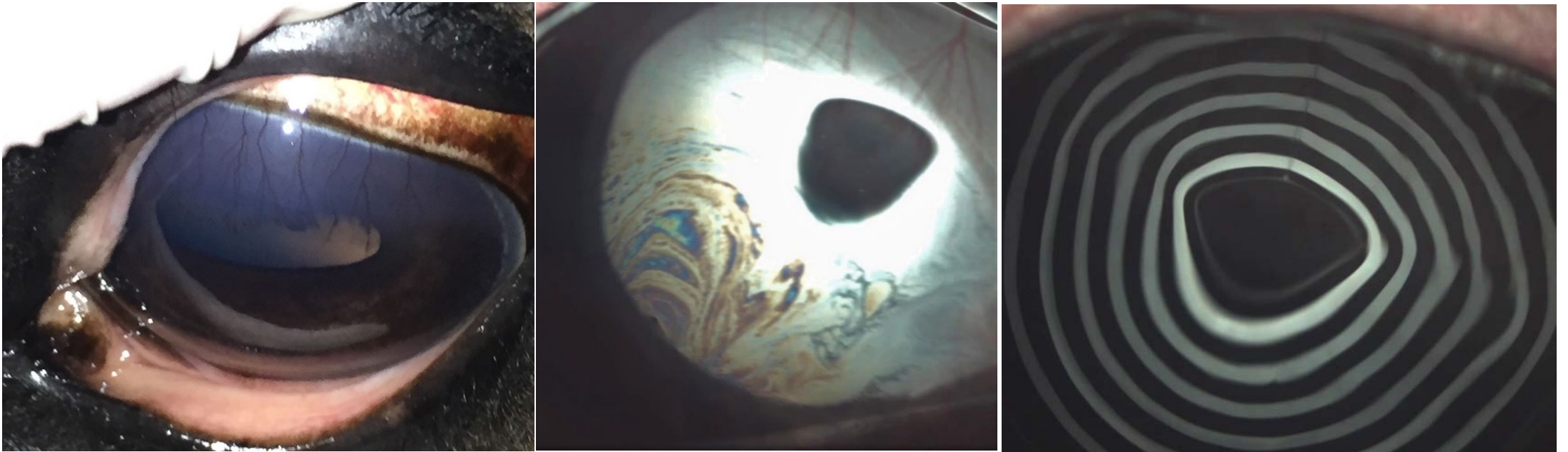
Not known breed, G, 22 yo, OS

RESULTS - corneal edema



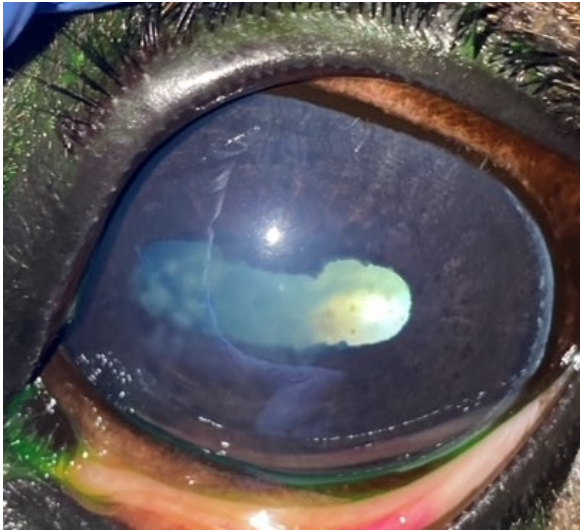
Selle français, F, 11 yo, OS

RESULTS - superficial IMMK

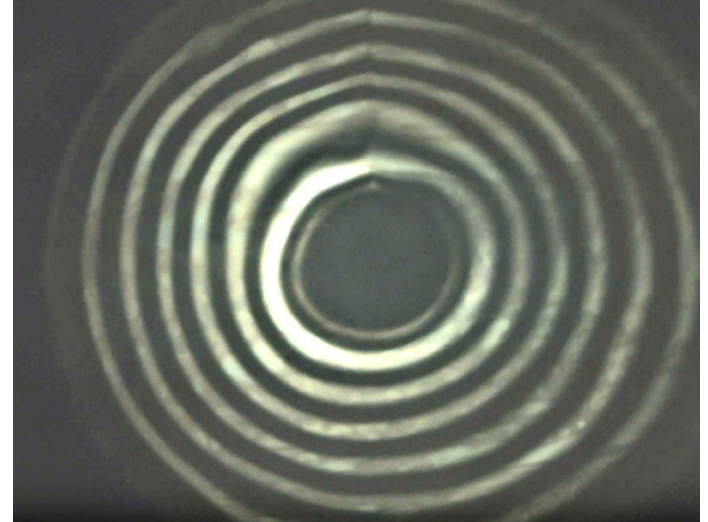
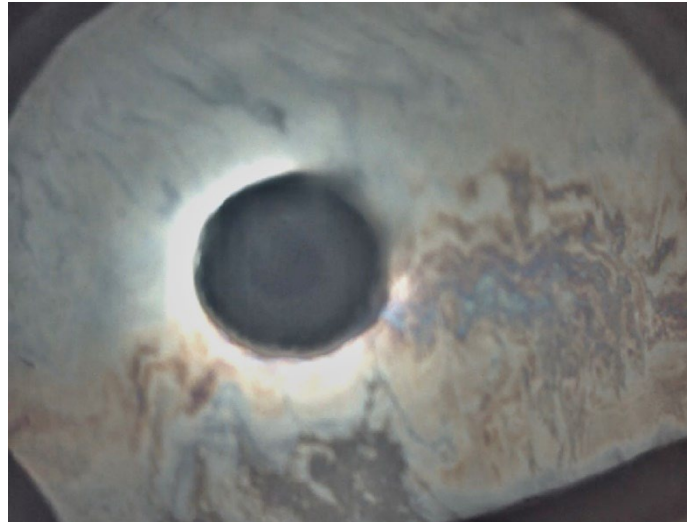


Holsteiner, F, 13 yo, OS

RESULTS - stromal IMMK



Italian Saddle Horse, F, 9 yo, OS

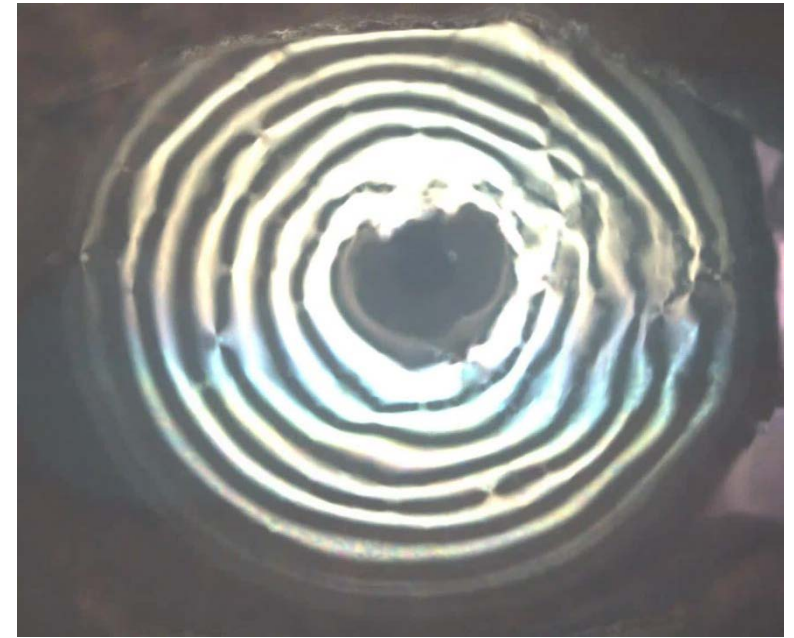
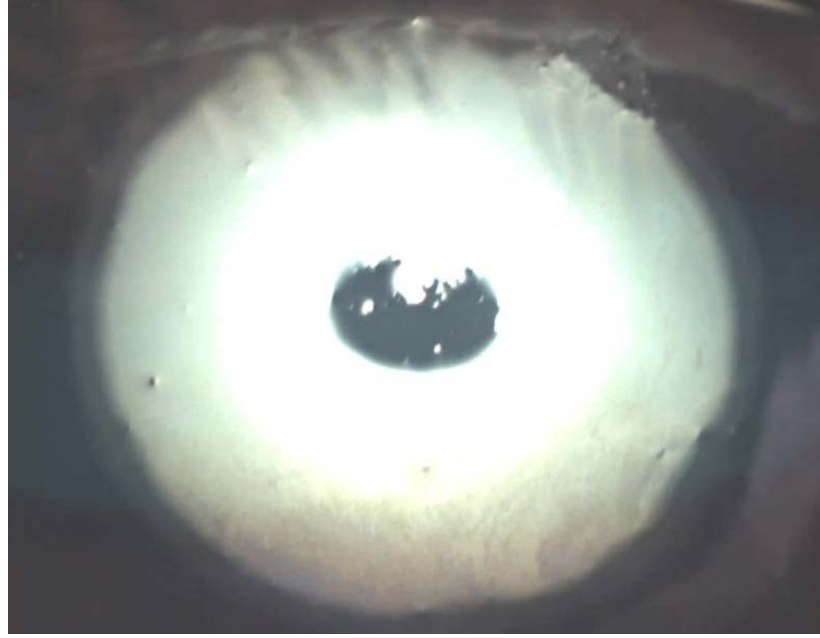
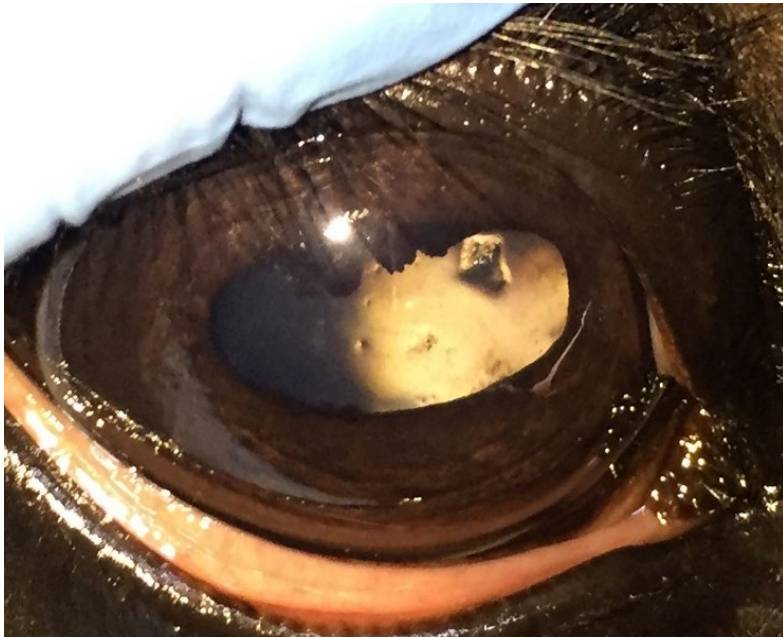


RESULTS - fungal punctate keratitis



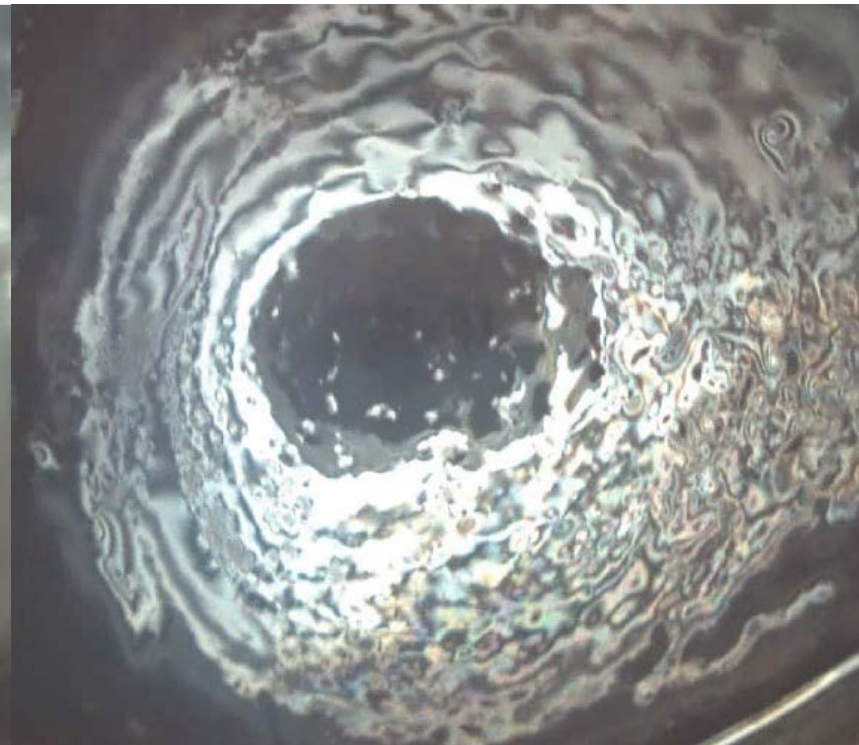
Holsteiner, G, 10 yo, OS. Punctate keratitis diagnosed as SEK. Fluorescein and rose bengal positive. *Staph. aureus*

RESULTS - fungal punctate keratitis



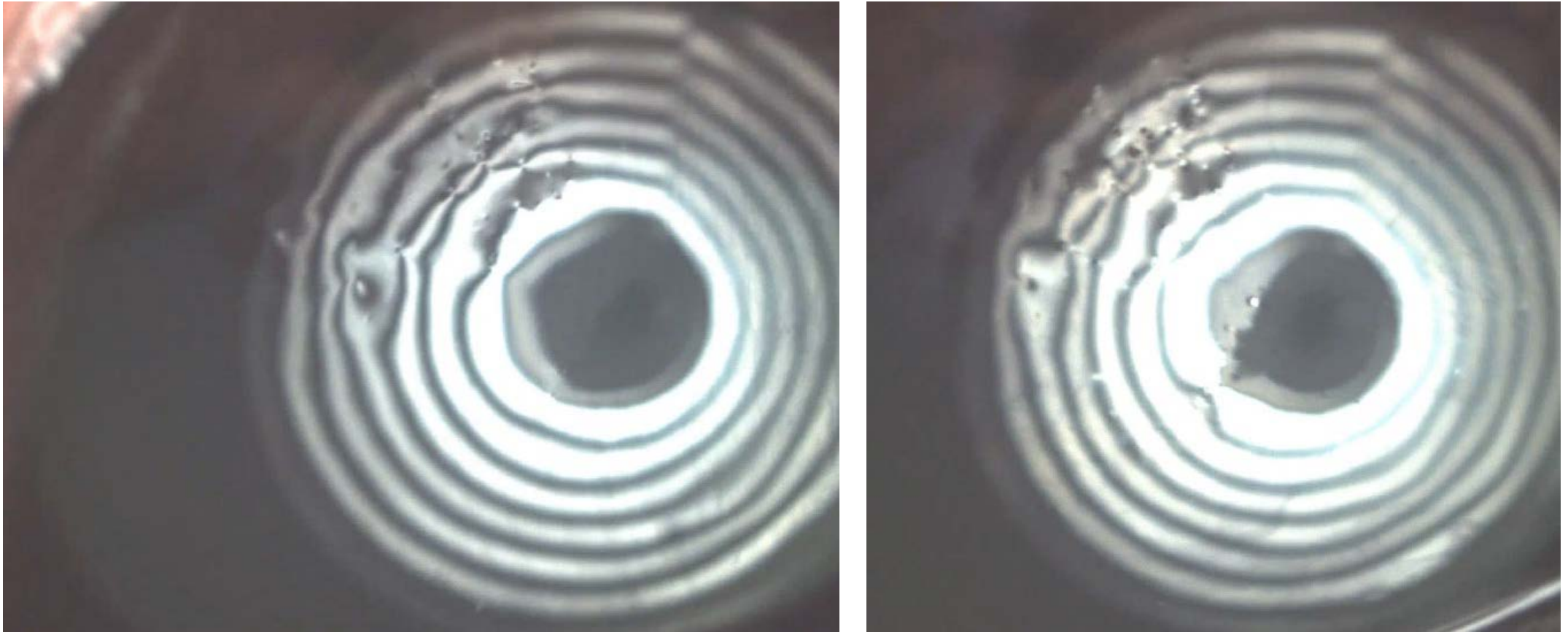
Italian Saddle Horse, F, 10 yo, OD. Corneal ulcer surrounded by punctate keratitis (*Aspergillus niger*)

RESULTS - fungal punctate keratitis



Dutch saddle horse, F, 17 yo, OS

RESULTS - fungal punctate keratitis



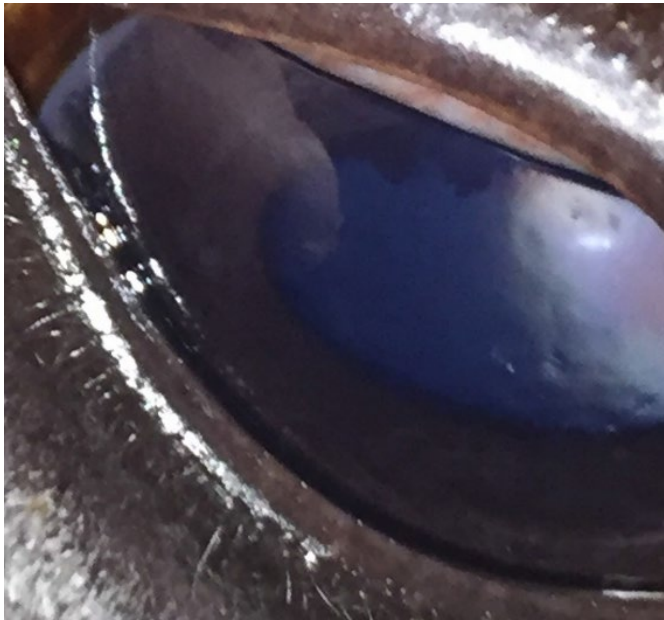
Dutch saddle horse, F, 17 yo, OS. Same eye of previous slide, after 3 weeks of antifungal treatment

RESULTS - fungal punctate keratitis



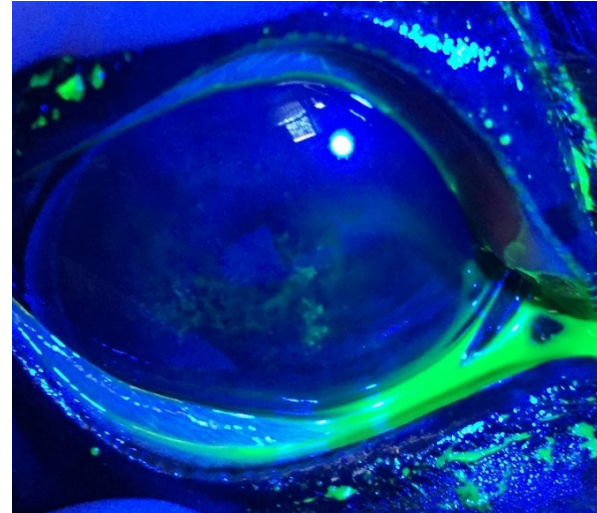
Dutch saddle horse, F, 17 yo, OS. Same eye of two previous slides, after 7 weeks of antifungal treatment

RESULTS - fungal punctate keratitis

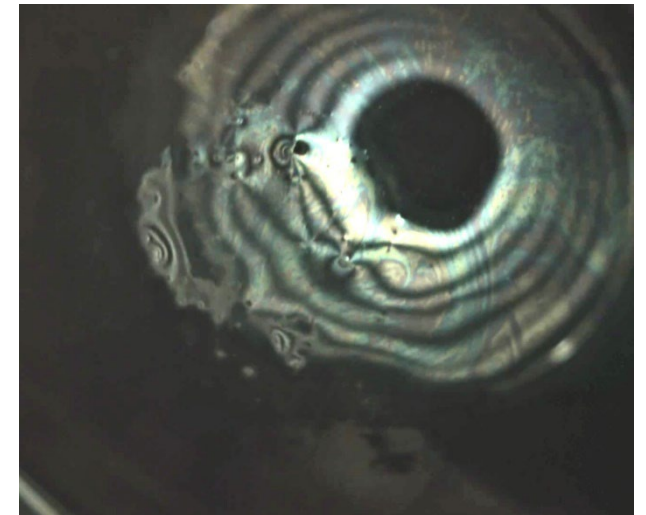
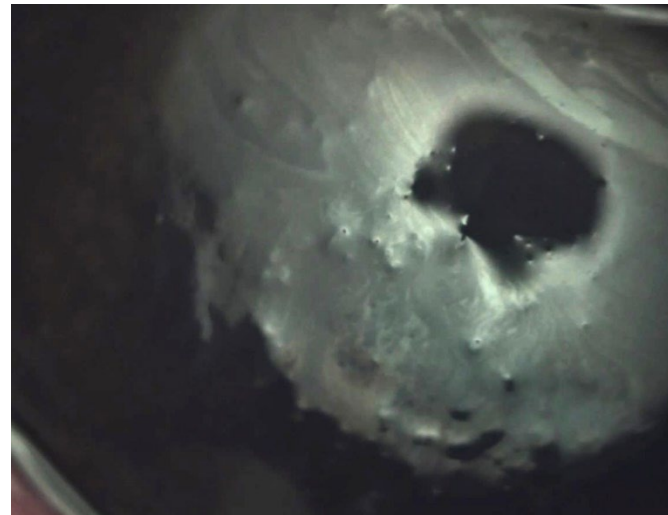


Purebred Arabian Horse, M, 3 yo, OD. Slight punctate keratitis, no signs of uveitis, rose bengal negative

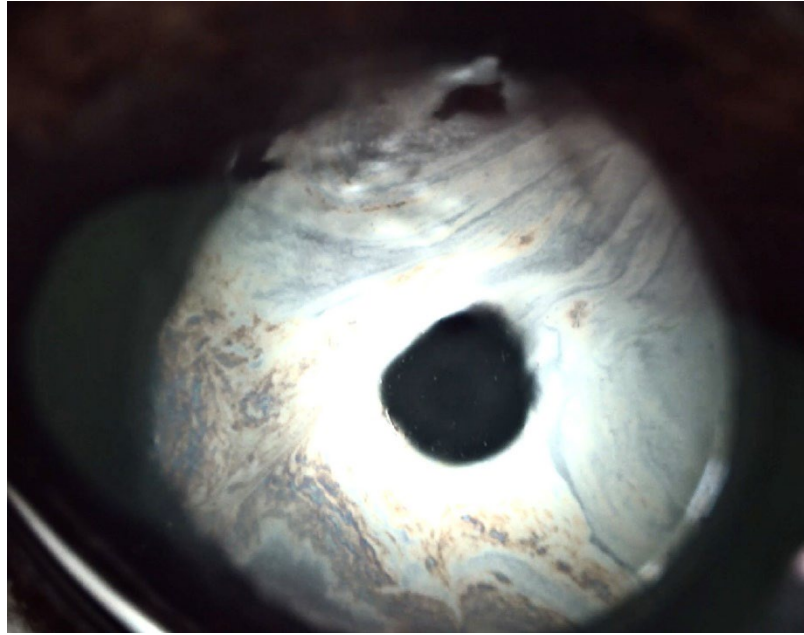
RESULTS - fungal punctate keratitis



Italian Saddle Horse, G, 17 yo, OD

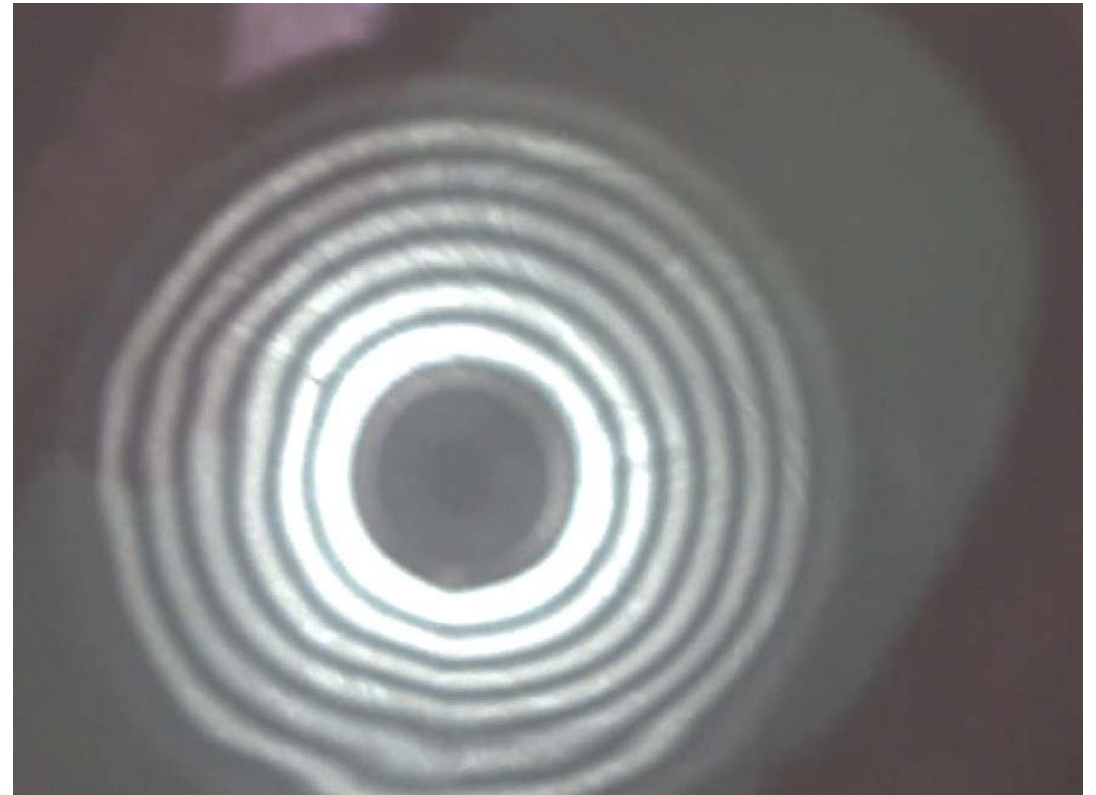
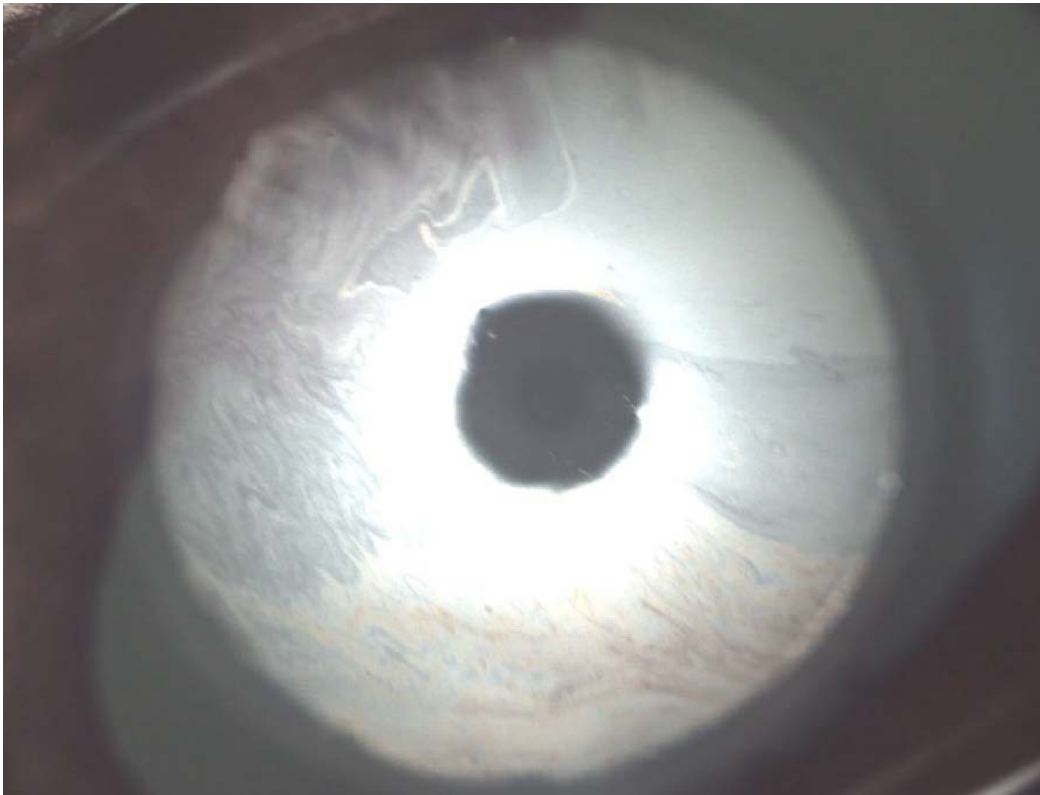


RESULTS - fungal punctate keratitis



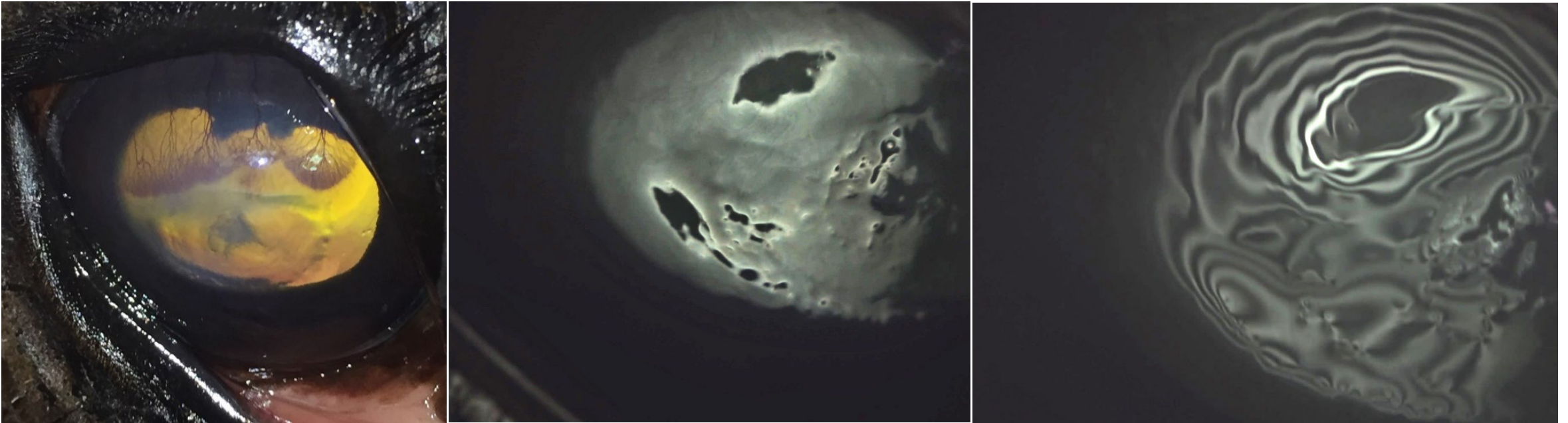
QH, G, 20 yo, OD. Punctate keratitis diagnosed as fungal, negative for laboratory tests

RESULTS - fungal punctate keratitis



QH, G, 20 yo, OD. Same eye of previous slide, after 3 weeks of antifungal treatment

RESULTS - fungal keratitis



Dutch saddle horse, F, 17 yo, OS. Severe keratitis healing from fungal infection (*Aspergillus flavus*), 9 days after diagnosis and > two weeks of treatment

RESULTS - fungal keratitis



Purebred Arabian Horse, G, 12 yo, OD

RESULTS

- A **high number** of horses was examined by TF interferometry
- Quick, cost effective, non invasive, helpful exam
- The fungal keratitis cases shared the common aspect of TF interferometry showing **ocular surface punctate irregularities**, corresponding to the clinical aspect
- Instead, in the non-infectious cases, the lesions were not visible with OSA-Vet evaluation
- Fungal keratitis cases (confirmed by healing with appropriate antifungal treatment or with positive laboratory culture) did not present these features once the keratitis was resolved

DISCUSSION

- Keratomycosis has a variety of clinical presentations in the horse that may represent a continuum of lesions (Brooks, 2013)
 - tear film disruption
 - epithelial micro-erosions
 - ulcerations of variable stromal depth
 - corneal dissolution and melting
 - corneal perforations and subsequent iris prolapse
 - stromal abscess
 - stromal plaque formation

DISCUSSION

- SEK: microerosions in the epithelium, invasion of the subepithelial region by fungi
- It may be that the subepithelial lesions seen in the interferometric images in the present study represent an initial stage of this migration of fungi towards the deeper cornea, or an extension in amplitude of the initial lesion
- The punctate corneal lesions might represent dense accumulations of dendritic cells or leukocytes surrounding antigenic material (eg, microorganisms, autoantigens) (Ledbetter, 2019)

DISCUSSION

- Clinical signs of iridocyclitis were absent in all eyes affected by SEK and examined by Brooks (2013). This is noteworthy, as it seems that not all cases of fungal keratitis (i.e., punctate keratitis) have uveitis as a distinctive sign, and not all cases are positive to rose bengal staining (like the case of the 3 yo pure arabian horse)
- TF interferometry could help distinguish / highlight subepithelial lesions, mostly present in fungal disease

CONCLUSION

- Evaluation of the ocular surface in horses is important when added to complete ophthalmic examination
- TF quality deficiency is underestimated in horses
- Fungal keratitis cases had interferometry highlighting punctate lesions
- Punctate IMMK did not have OSA-Vet showing punctate lesions, but punctate keratitis was visible clinically
- More studies are warranted
- No conflicts of interest

REFERENCES

- Brooks D.E., Andrew S.E., Denis H.M., Strubbe D.T., Biros D.J., Cutler T.J., Samuelson D.A., Gelatt K.N. *Rose bengal positive epithelial microerosions as a manifestation of equine keratomycosis*. *Veterinary Ophthalmology* (2000) **3**, 83-86
- Brooks D.E., Matthews A., Clode A.B. *Diseases of the cornea*
- Brooks D.E., Plummer C.E., Mangan B.G., Ben-Shlomo G. *Equine subepithelial keratomycosis*. *Veterinary Ophthalmology* (2013) **16**, 2, 93-96
- Cutler T.J. *Corneal epithelial disease*. *Vet Clin Equine* (2004) **20**, 319-343
- Ford M.A. *Antifungals and their use in veterinary ophthalmology*. *Vet Clin Small Anim Pract* (2004) **34**, 669-691
- Galan A., Martin-Suarez E.M., Gallardo J.M., Molleda J.M. *Clinical findings and progression of 10 cases of equine ulcerative keratomycosis (2004–2007)*. *Equine Vet. Educ.* (2009) **21**, 5, 236-242
- Galera P.D, Brooks D.E. *Optimal management of equine keratomycosis*. *Veterinary Medicine: Research and Reports* (2012) **3**, 7-17
- Kammergruber E., Rahn C., Nell B., Gabner S., Egerbacher M. *Morphological and immunohistochemical characteristics of the equine corneal epithelium*. *Veterinary Ophthalmology* (2019) 1-13
- Knickelbein K.E., Scherrer N.M., Lassaline M. *Corneal sensitivity and tear production in 108 horses with ocular disease*. *Veterinary Ophthalmology* (2017) 1-6
- Ledbetter E.C., Irby N.L., Leandro B.C., Teixeira L.B.C. *In vivo confocal microscopy characteristics of equine epithelial and subepithelial nonulcerative keratomycosis*. *Veterinary Ophthalmology* (2019) **22**, 168-176
- Matthews A. *An overview of recent developments in corneal immunobiology: potential relevance in the etiogenesis of corneal disease in the horse*. *Veterinary Ophthalmology* **11** (2008) Supplement 1, 66-76
- Matthews A. and Gilger B.C. *Equine immune-mediated keratopathies*. *Veterinary Ophthalmology* (2009) **12**, Supplement 1, 10-16
- Matthews A., Gilger B.C. *Equine immune-mediated keratopathies*. *Veterinary Ophthalmology* (2009) **12**, Supplement 1, 10-16
- Matthews A.G. *Nonulcerative keratopathies in the horse*. *Equine Vet. Educ.* (2000) **12**, 5, 271-278
- Mustikka M.P., Grönthal T.S.C., Pietilä E.M. *Equine infectious keratitis in Finland: Associated microbial isolates and susceptibility profiles*. *Veterinary Ophthalmology* (2020) **23**, 148-159
- Pate D.O., Clode A.B., Olivry T., Cullen J.M., Salmon J., Gilger B.C. *Immunohistochemical and immunopathologic characterization of superficial stromal immune-mediated keratitis in horses*. *AJVR* (2012) **73**, No. 7
- Scotty N.C., *Equine Keratomycosis*. *Equine Practice* (2005) **4**, 1, 29-36
- Strubbe D.T., Brooks D.E., Schultz G.S., Willis-Goulet H., Gelatt K.N., Andrew S.E., Kallberg M.E., Mackay E.O., Collante W.R. *Evaluation of tear film proteinases in horses with ulcerative keratitis*. *Veterinary Ophthalmology* (2000) **3**, 111-119
- Voelter-Ratson K., Pot S.A., Florin M., Spiess B.M. *Equine keratomycosis in Switzerland: A retrospective evaluation of 35 horses (January 2000–August 2011)*. *Equine Veterinary Journal* (2013) **45**, 608-612