イヌにおける涙液インターフェロメトリについての検討

A clinical study of tear interferometry in dogs

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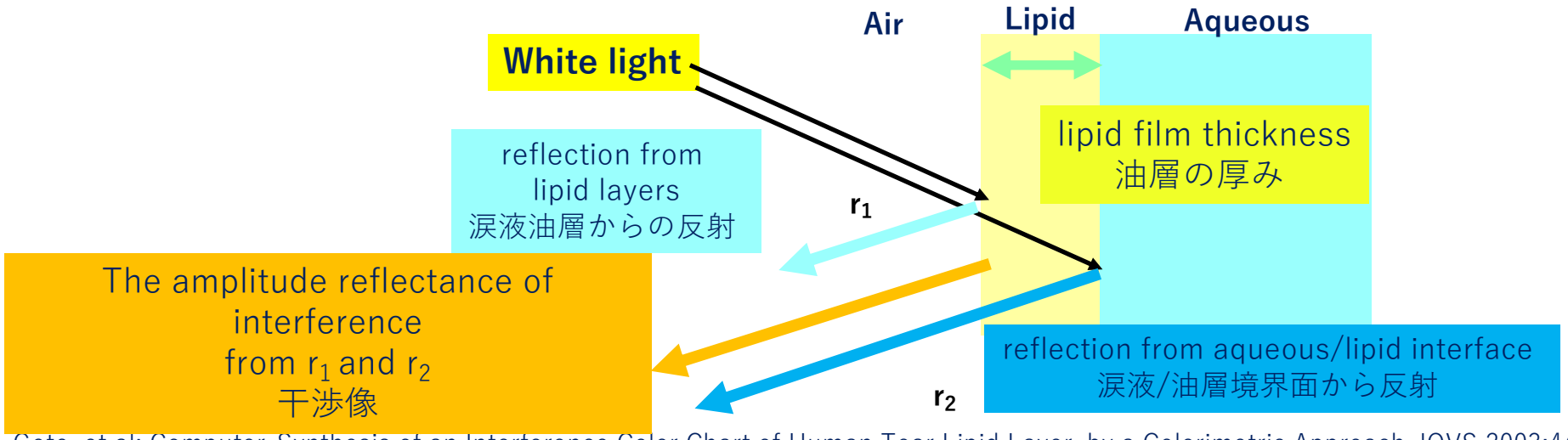
Introduction

- Recently, noninvasive Tear film breakup time(NIBUT), lipid layer thickness, and noncontact meibography, have been developed to complement the diagnosis of meibomian gland dysfunction and dry eye disease in human ophthalmology.

Introduction

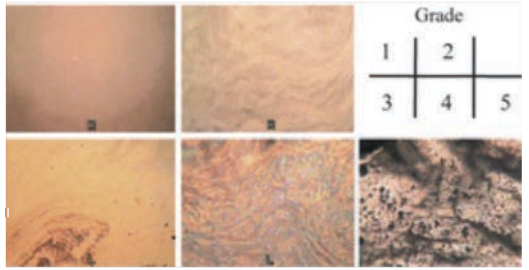
- Interferometry is a diagnostic procedure that permits the imaging of the interference pattern of the tear film.
- This pattern is created by the lipid layer at its interface with the aqueous subphase of the tear film.



Goto et al: Computer-Synthesis of an Interference Color Chart of Human Tear Lipid Layer, by a Colorimetric Approach. IOVS 2003;44 : 4693-4697

Introduction

- Yokoi et al classified the interferometric pattern by using DR-1 to determine severity of dry eye[1].
- Craig et al described seven patterns depending on the thickness of the lipid layer with the Keeler Tearscope[2].
- Arita et al also classified into three grading patterns in terms of lipid layer thickness[3].



	Lipid layer pattern	Estimated thickness (nm)	Appearance
1	Absent	<10	No visible layer
2	Open meshwork	10–20	Very thin white–blue laye
3	Closed meshwork	20–40	Thin white–blue layer
4	Flow	30–90	White–blue layer with distinct colors
5	Amorphous	80–90	Dens white–blue layer
6	Normal colored fringes	>100	Waves with gradually changing colors
7	Abnormal colored fringes	Variable	Highly variable colored areas

Gwendolyna Romkes, et al. Veterinary Ophthalmology (2014) 17, 1, 32–40

1) Yokoi, N.,et al , 1996. Correlation of tear lipid layer interference patterns with the diagnosis and severity of dry eye. 1996; Am. J. Ophthalmol. 122, 818–824.

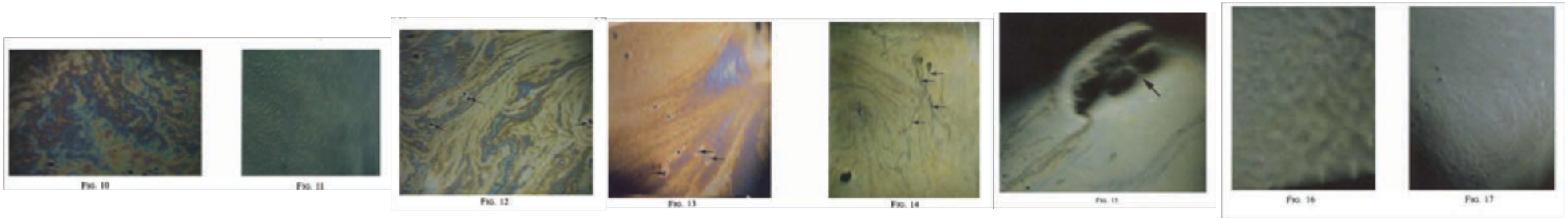
2) Craig JP, Tomlinson A. Optometry and Vision Science 1997; 74: 8–13

3) Arita,R.,et al. Tear Interferometric Patterns Reflect Clinical Tear Dynamics in Dry Eye Patients. 2016 IOVS; Jul 1;57(8):3928-34

Introduction

- In veterinary ophthalmology, Carrigton et al had reported polarized light biomicroscopic observations on the pre-corneal tear film in normal and Keratoconjunctivitis sicca dog.

  Carrington, J. small Animal practice,1987 28,605-622



- Recently, Romkes observed NIBUT to evaluate eyelid function indirectly after wedge excision of eyelid tumors.

  Gwendolyna Romkes, Veterinary Ophthalmology (2014) 17, 1, 32–40

Purpose

- To our knowledge, there is a few reports of interferometry in dog.
- To evaluate tear film by interferometry using a new instrument, I.C.P OSA(SBM).

Material and Method

- **Subject**

  Dogs presented to Triangle Animal Eye Clinic and examined

  Ocular surface test from July 2017 to May 2018.

- **Exclusion**

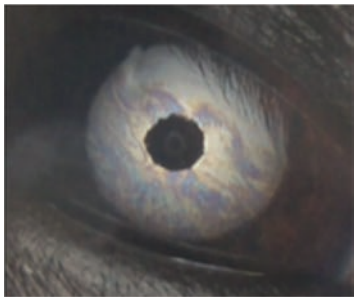
  Corneal ulcer, endothelial corneal dystrophy, glaucoma, exophthalmos,

  eyelid mass, cherry eye, post ophthalmic surgery

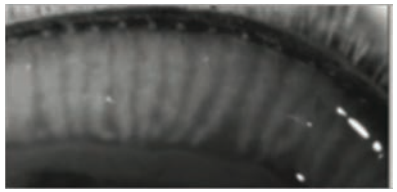
Material and Methods

Ocular surface screening tests

Interferometry (IF)



meibography



Phenol Red Thread (PRT)

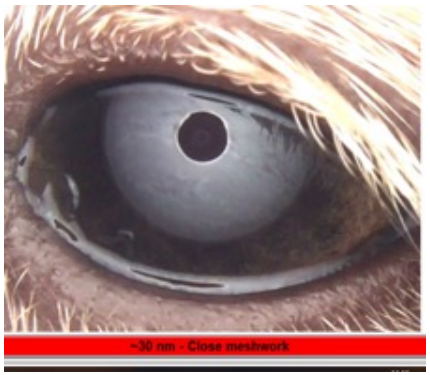
Strip Meniscometry tube (SM)

Schirmer Tear Test (STT)

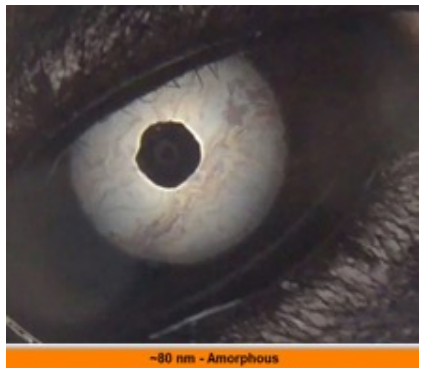
All cases were examinied by the same veterinary ophthalmologist(A.S)

Material and method

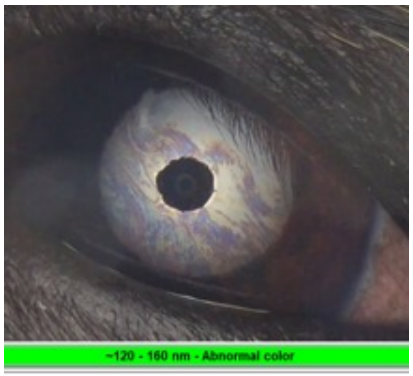
- Lipid layer thickness
  - Assessed by interferometry using the O.S.A (SBM Sistemi, Turin, Italy)
  - The lipid layer thickness was graded from 1 to 3 based on the observed lipid layer patterns.



Grade 1
<30nm



Grade 2
30-80nm



Grade 3
80-120nm

Material and Method

- Meibography score
  - Assessed by using the O.S.A(SBM Sistemi, Turin, Italy)
  - Scored by the evidence of gland dropout (Upper eyelid).

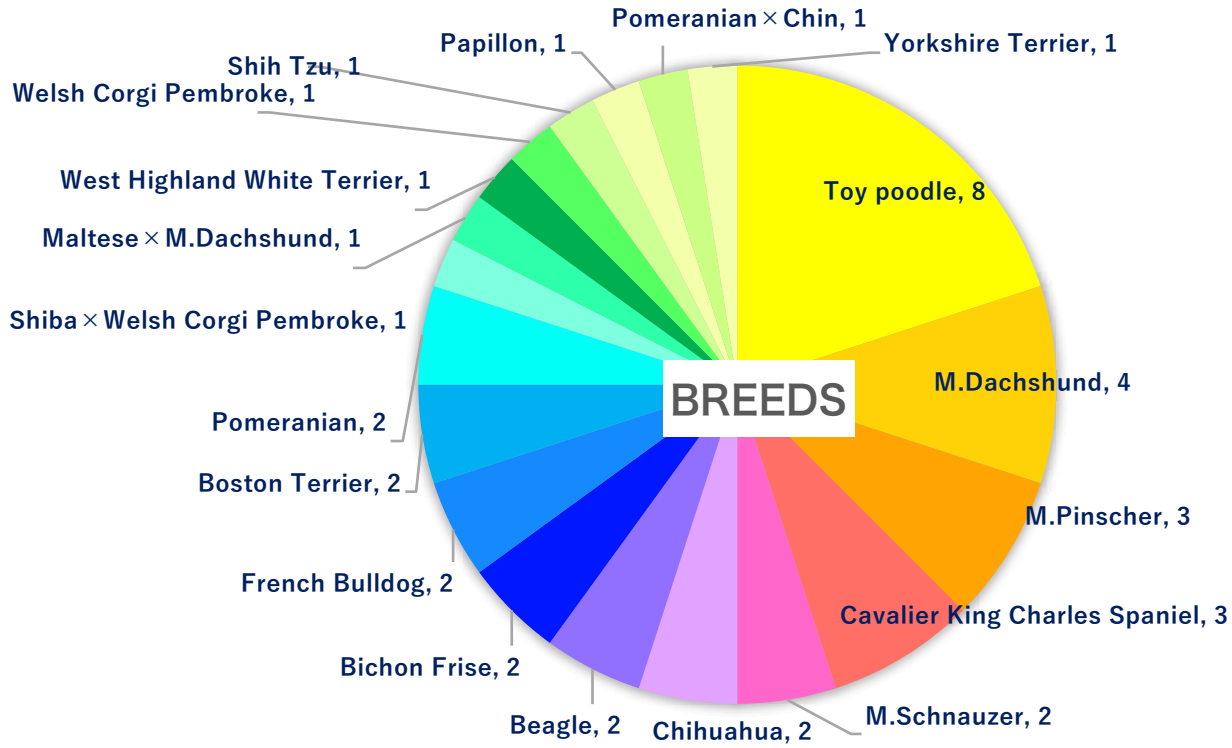
    Grade1: Lid has no missing glands or <33 %

    Grade2: Involved lid area is 33–66%

    Grade3: Involved lid area is >66%
- Statistic analysis
  - JMP ver.14
  - Spearman's rank correlation coefficient
  - Mann–Whitney *U* test

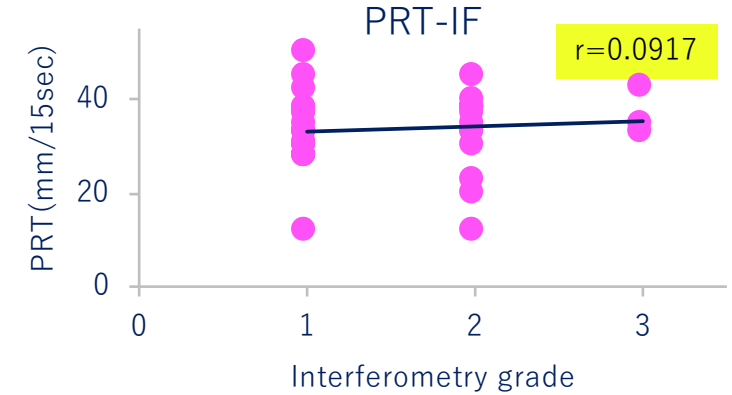
Result

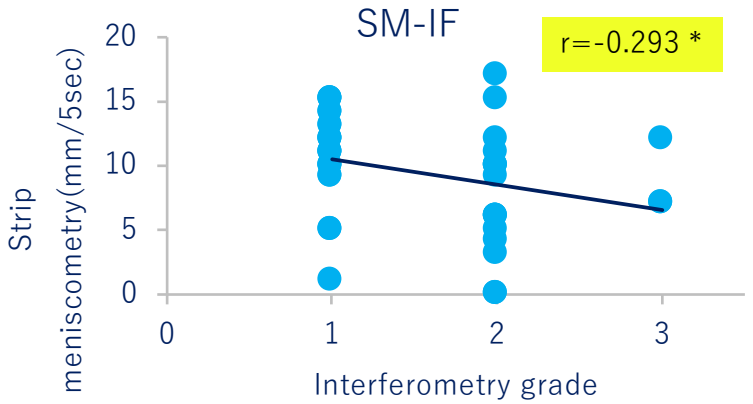
- A total of 40eyes of 40 dogs were included in this study.
  - 36 left eyes,　4 right eyes.
- Sex:　14 males (11 castrated),　26 females(20 spayed)
- Age: 6.6 ± 4 years
- Breeds:

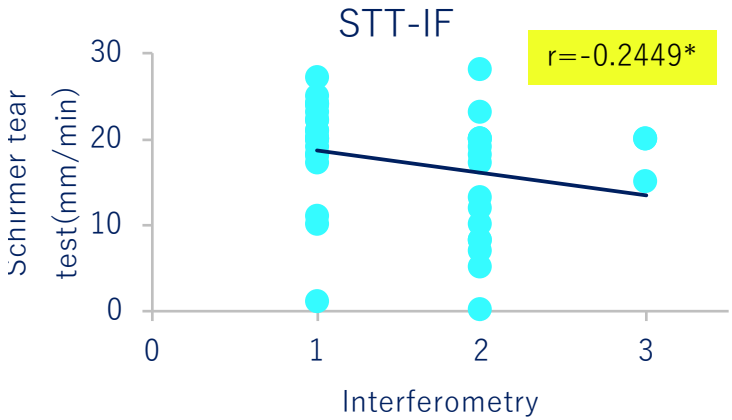


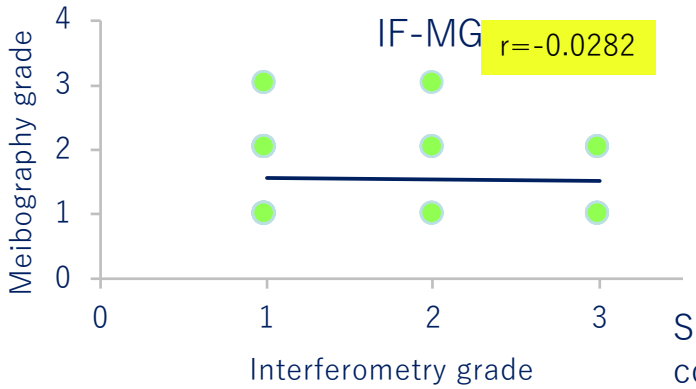
Result

Total parameter score







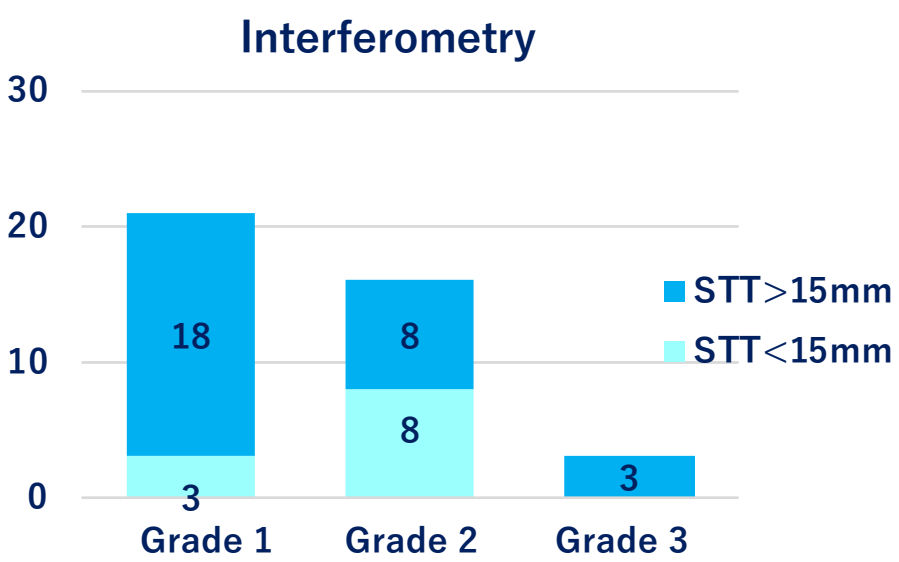


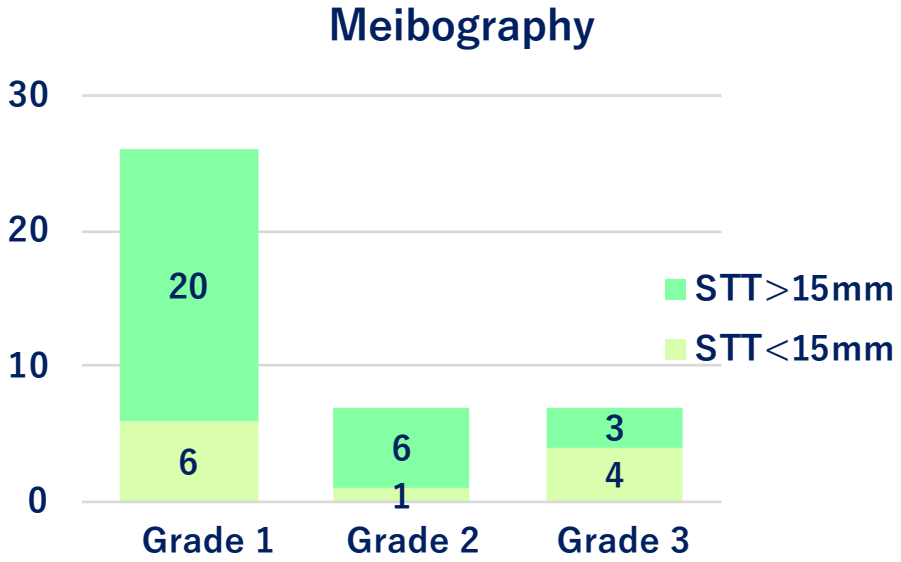
There were significant correlation between SM-IF and STT-IF

Spearman's rank correlation coefficient $p<0.05$

	PRT	SMT	STT	Interferometry Grade	Meibography score
Mean ± SD	34.2 ± 7.6	9.4 ± 4.3	17.1 ± 6.7	1.5 ± 0.6	1.5 ± 0.8

Result





	N (eye)	Interferometry Score	Meibography score
STT<15mm/min	11	1.7±0.5	1.8±1.0
STT≧15mm/min	29	1.5±0.7	1.4±0.7

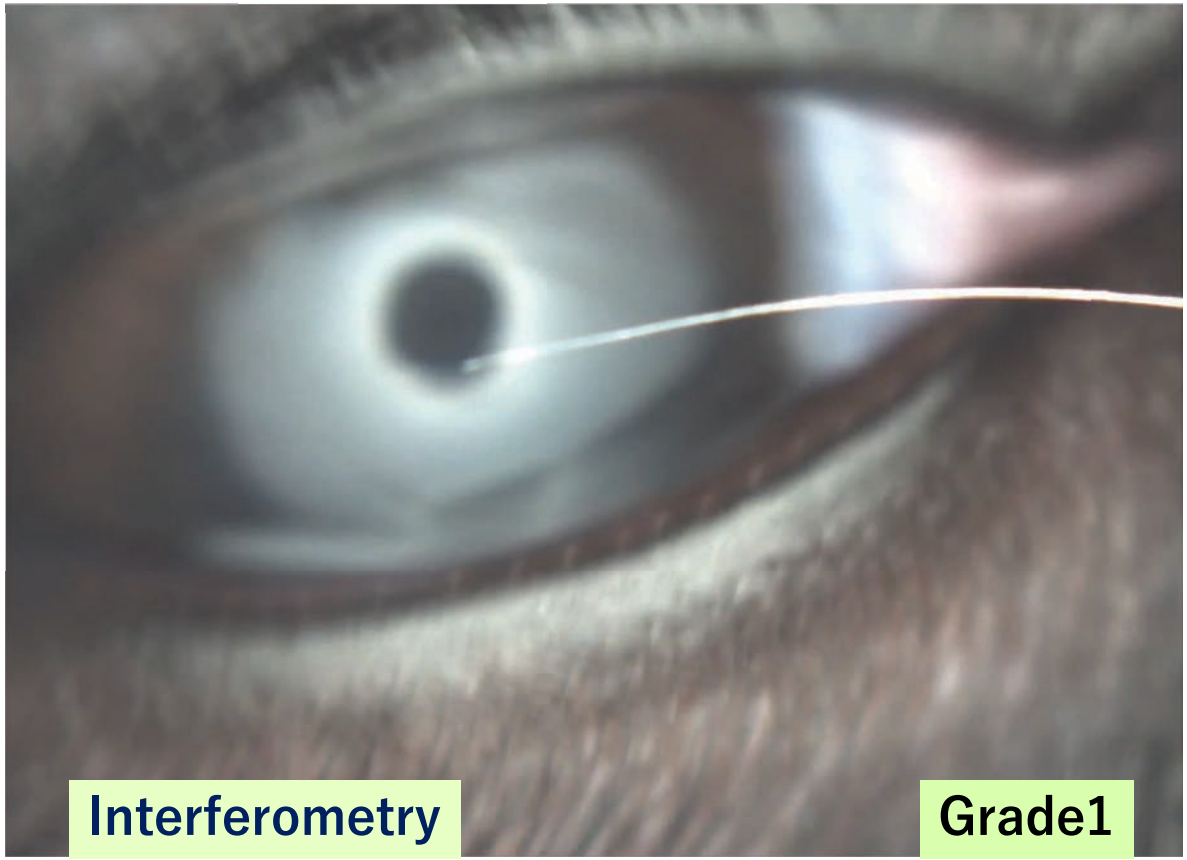
Mann–Whitney *U* test IF:p=0.14 Meibography:p=0.23

There was no significant difference.

Result

Triangle Animal Eye Clinic

Chihuahua 5 month old Fs

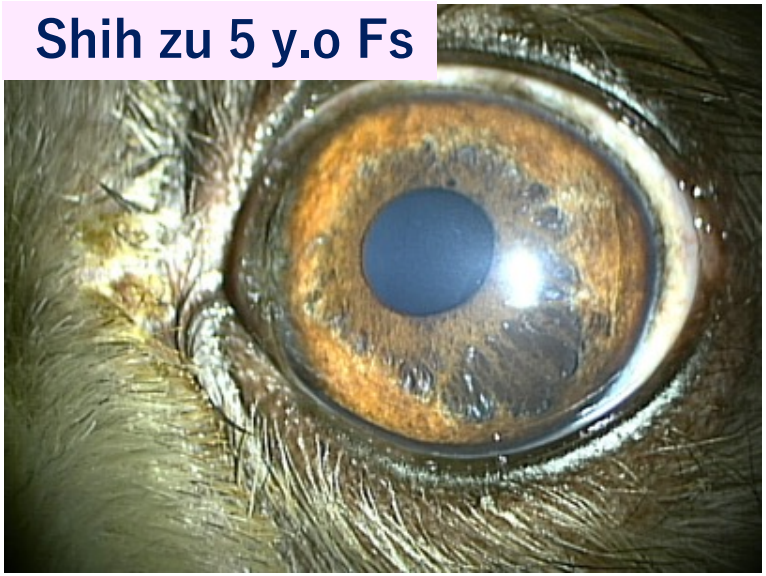


PRT	SMT	STT
30	11	23

Result

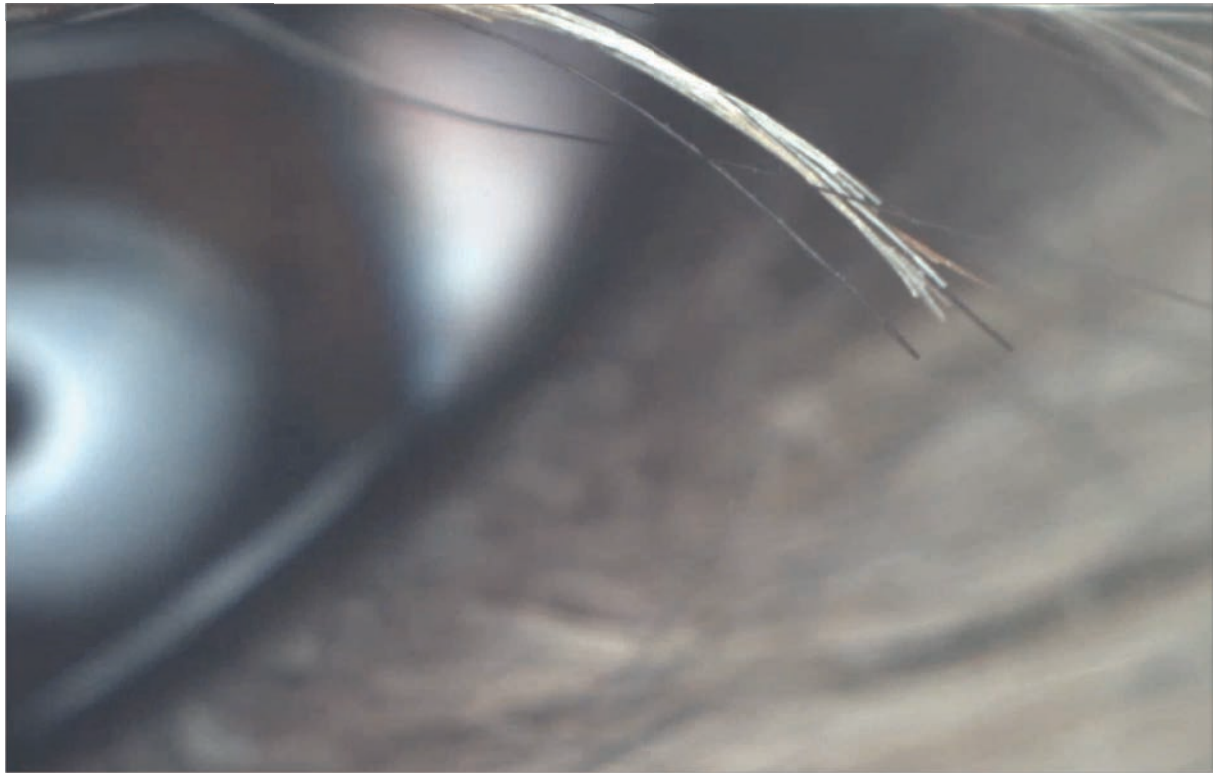
Triangle Animal Eye Clinic

Shih zu 5 y.o Fs



Meibography

Grade 1



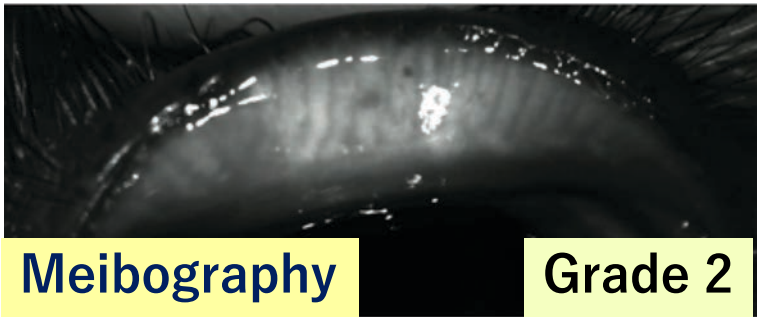
Interferometry

Grade 2

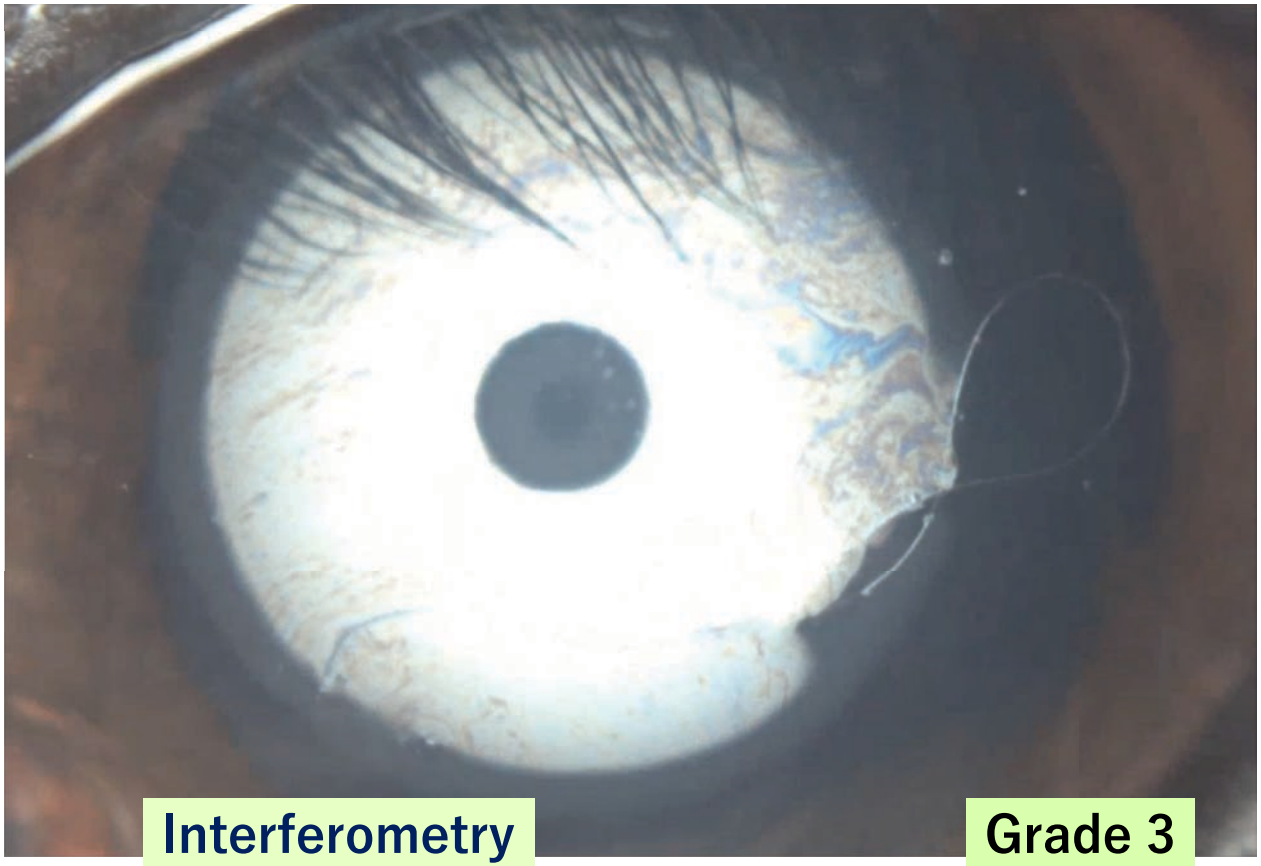
PRT	SMT	STT
30	6	12

Result

Yorkshire terrier 8 y.o. F



Meibography Grade 2



Interferometry Grade 3

PRT	SMT	STT
33	7	15

Discussion

- Interferometry score had significant correlation between **SM** and **STT.**
- **Twenty six** cases(26/40) showed less than 33% loss of meibomian gland.
- **Twenty-one cases**(21/40)showed less than 30nm of lipid layer.

The possibility of deficient secretion of meibum.

Discussion

- Interestingly, cases who classified into grade 3 showed more than 15mm/min at STT.

The possibility of aqueous deficiency on the ocular surface.

- Observing tear interferometry in dogs has possibility to evaluate the balance of aqueous and lipid on ocular surface.

Conclusion

- Tear interferometry has possibility to evaluate the balance of aqueous and lipid on ocular surface.