

Evaluation of the optic nerve head and peripapillary retinal nerve fiber layer using optical coherence tomography in normal canines

Trang Le, Michelle Ferneding, Vanessa Ureno, Maria Do, Chung-Chih Luo, and Dr. Soohyun Kim

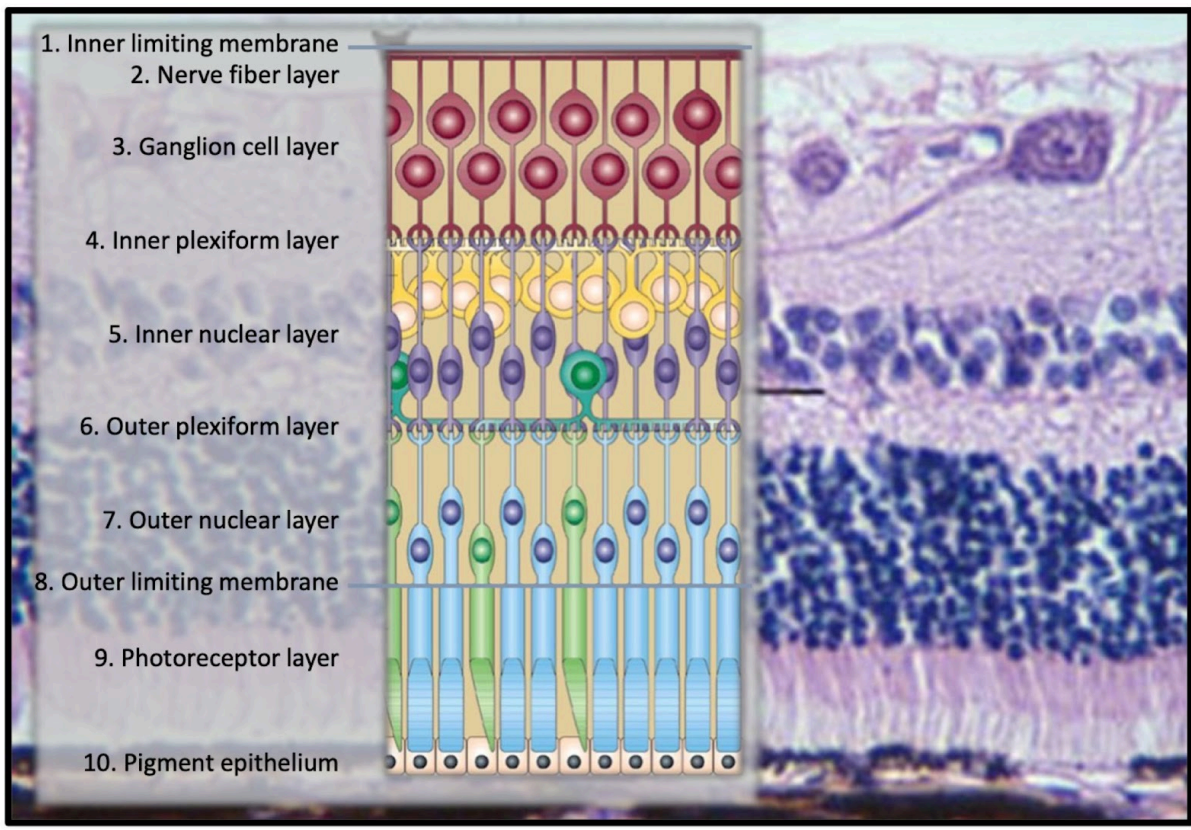
The background features a large, light blue watermark of the University of California seal. The seal is circular and contains a central figure holding a book and a torch, with the word "LIGHT" on a banner below. The words "UNIVERSITY OF CALIFORNIA" are written around the perimeter of the seal.

What is Optical Coherence Tomography (OCT)?



OCT

ultrasound of the cellular layers of the retina





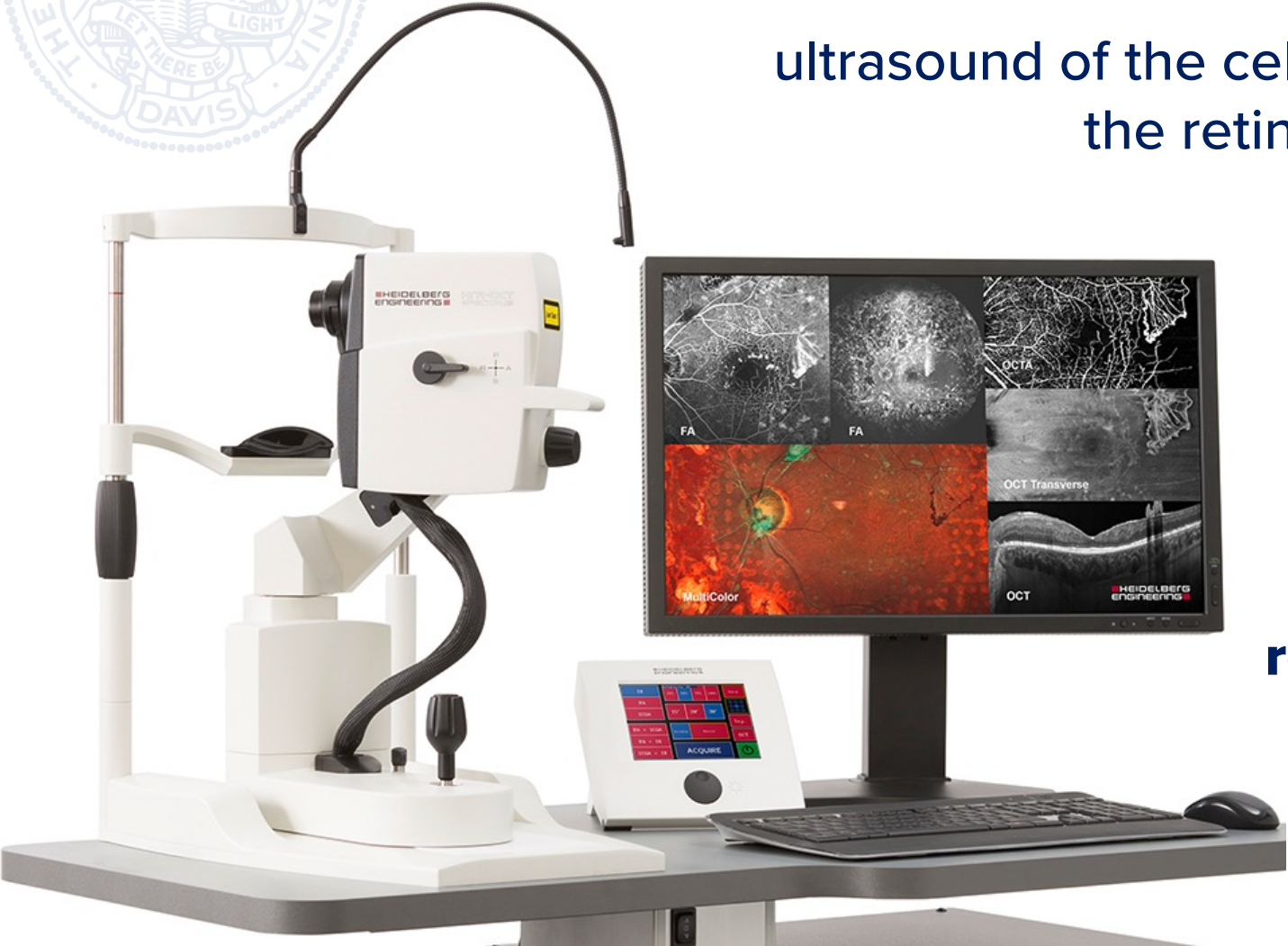
OCT

ultrasound of the cellular layers of the retina

used in human medicine to monitor vision-threatening conditions

repetitive!

non-invasive!



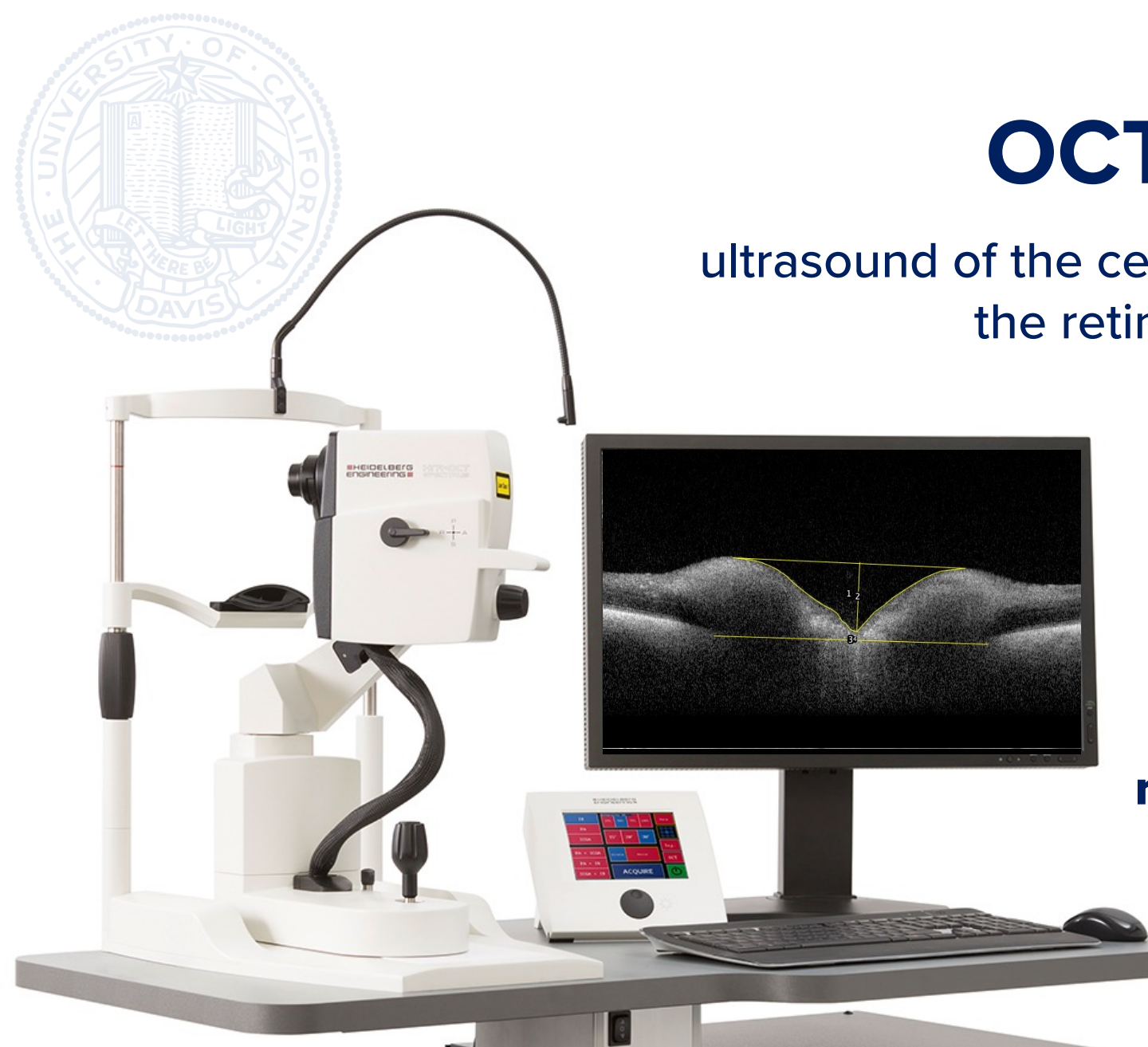
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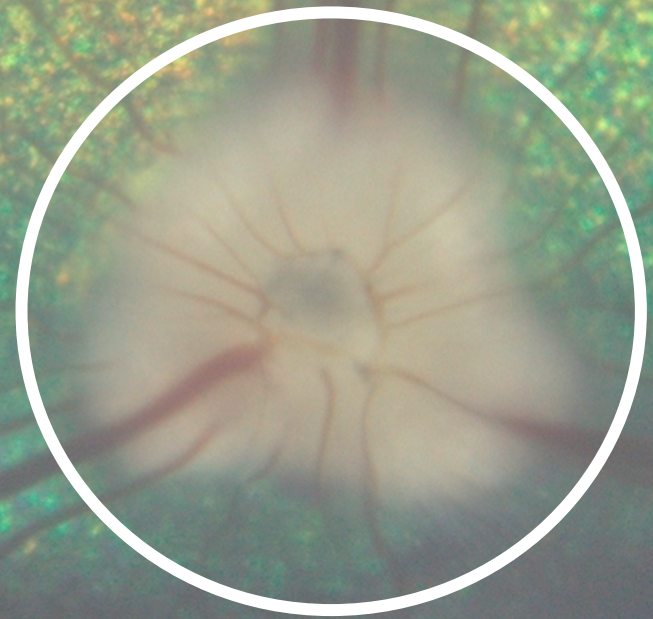
repetitive!

non-invasive!



Objective

This study aims to ***establish reference ranges for measurements of the optic nerve head (ONH) and peripapillary retinal nerve fiber layer (RNFL) using optical coherence tomography (OCT) in normal canines*** to monitor patients predisposed to or suffering from glaucoma and prolonged vision.





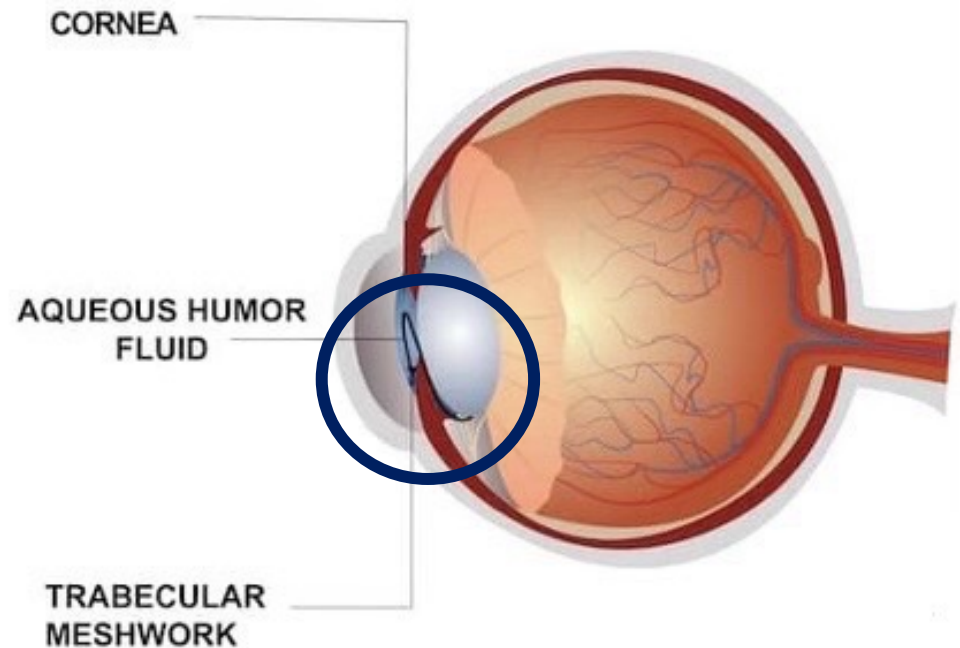
Why is this important?

Glaucoma

In dogs, one of the most common vision-threatening and painful ocular diseases

↑ intraocular pressure
(IOP)

NORMAL EYE



Glaucoma

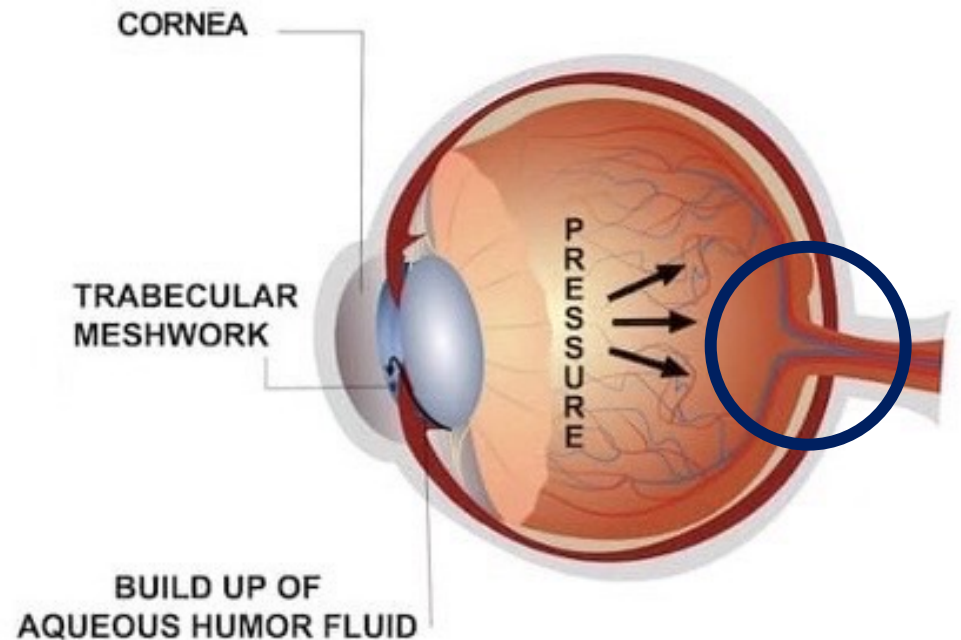
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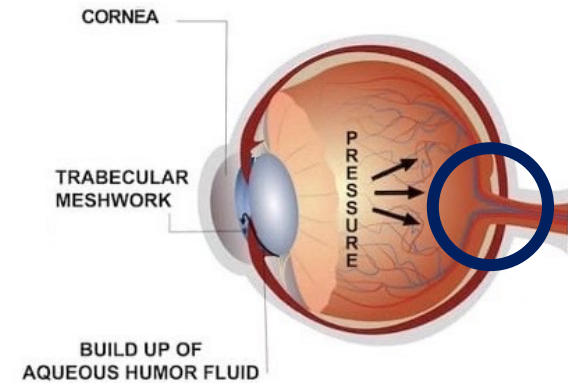


pain and irreversible
damage to the optic
nerve head (ONH) and
retina

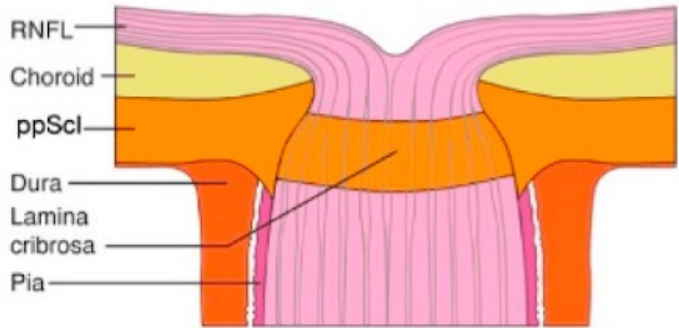
GLAUCOMA



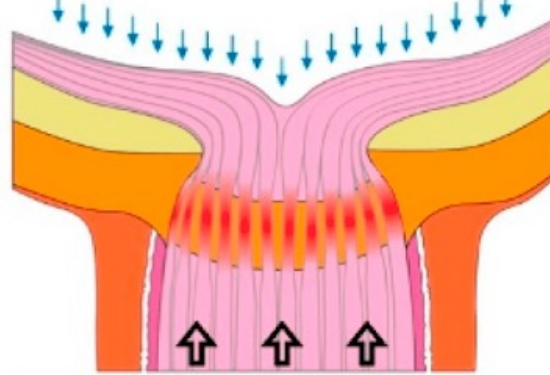
Glaucoma



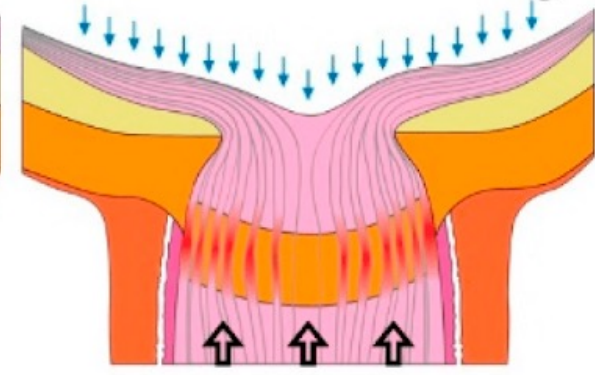
A ONH Anatomy



B Acute IOP Increase



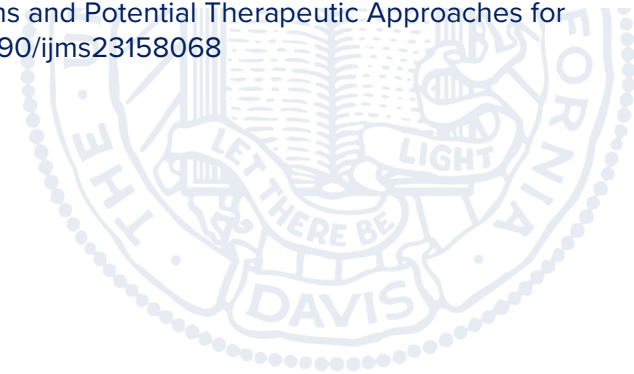
C Chronic Remodeling



Strickland RG, Garner MA, Gross AK, Girkin CA. Remodeling of the Lamina Cribrosa: Mechanisms and Potential Therapeutic Approaches for Glaucoma. *International Journal of Molecular Sciences*. 2022; 23(15):8068. <https://doi.org/10.3390/ijms23158068>



blindness



Controlling Glaucoma

- Timely diagnoses
- Consistent therapeutics
- *Frequent monitoring*





Methods

Recruiting

- Enroll 8 normal dogs
 - Without history of ocular disease
 - 4 males and 4 females
 - 5-7 years of age
 - 10-20 kg in weight



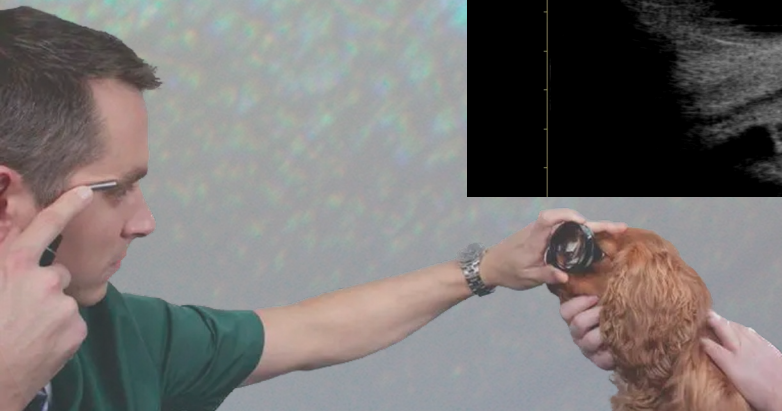
Recruiting

- ~~Enroll 8 normal dogs~~ Enroll **12** normal dogs
 - Without history of ocular disease
 - ~~4 males and 4 females~~ **6** males and **6** females
 - ~~5-7 years of age~~ **4.5-8.75** years of age
 - ~~10-20 kg in weight~~ **7.8-45.5** kg in weight



Ophthalmic and Glaucoma Work-up

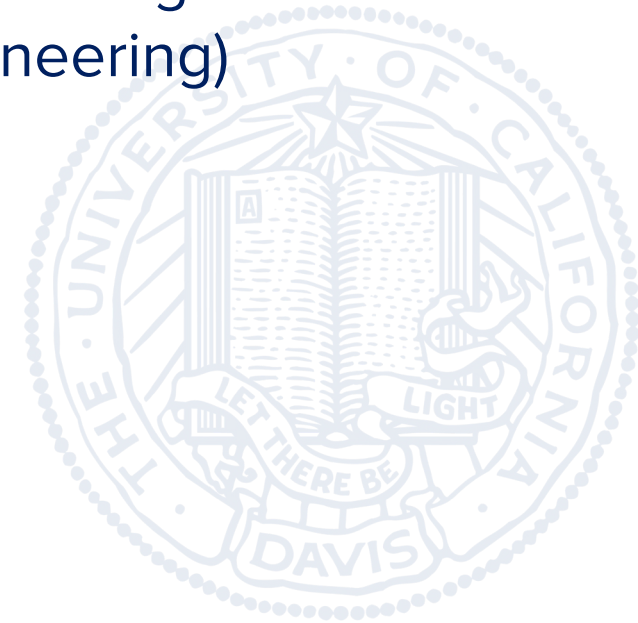
- Comprehensive ophthalmologic examination
 - Slit-lamp biomicroscopy
 - Fundic exam – indirect ophthalmoscopy, fundic photography
- Glaucoma work-up
 - Tonometry (TonoVet[®] ; Icare, Helsinki, Finland)
 - Gonioscopy
 - Ultrasound biomicroscopy (Compact Touch STS/UBM, Quantel Medical, Cournon d’Auvergne, France)



Imaging

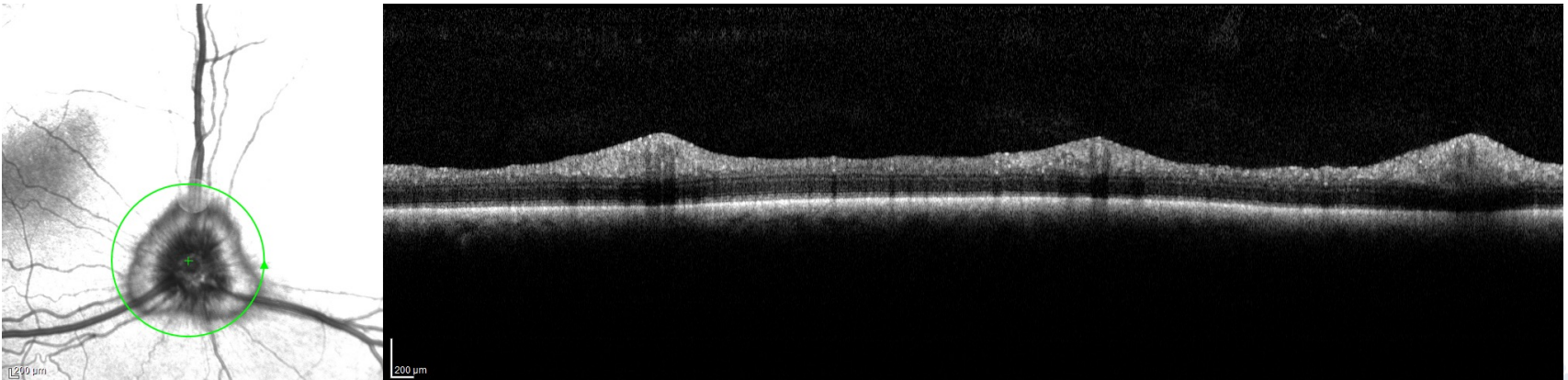


- Subjects were sedated
- MANY OCT images were taken (Spectralis[®], Heidelberg Engineering)

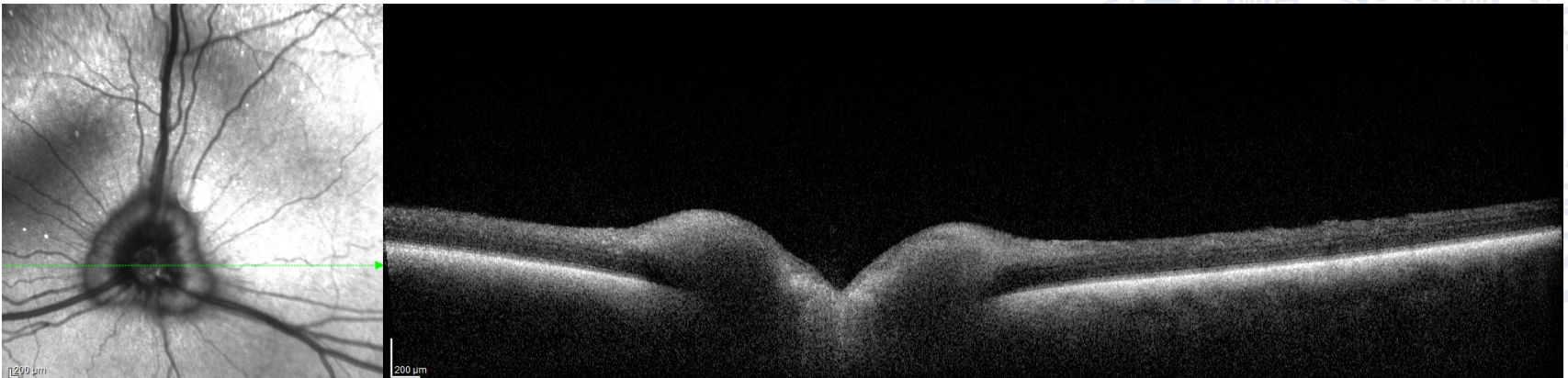


Imaging

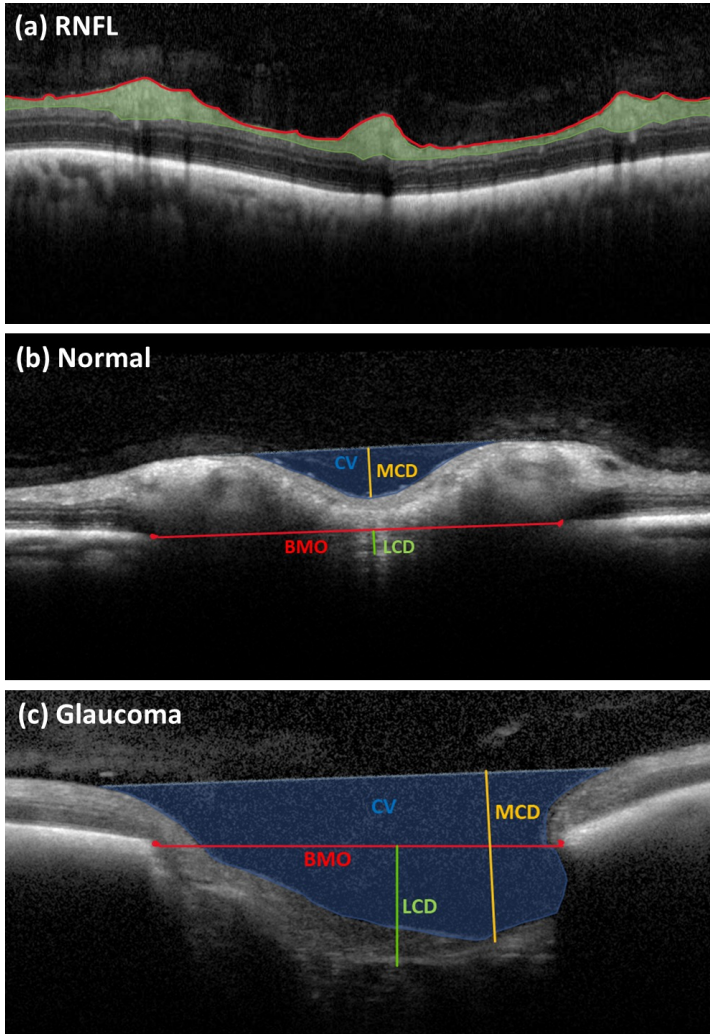
Circle – peripapillary RNFL



Line – ONH parameters



Measurements



- *Measured using ImageJ*
- Area of peripapillary RNFL
- Cup Volume (CV)
- Maximum Cup Depth (MCD)
 - Depth of deepest portion of the cup
- Bruch's Membrane Opening (BMO)
 - Distance between each side of the termination of the retinal pigment epithelium layer (or neural canal opening)
- Lamina Cribrosa Displacement (LCD)
 - Perpendicular distance from BMO to posterior lamellar surface at the most depressed point



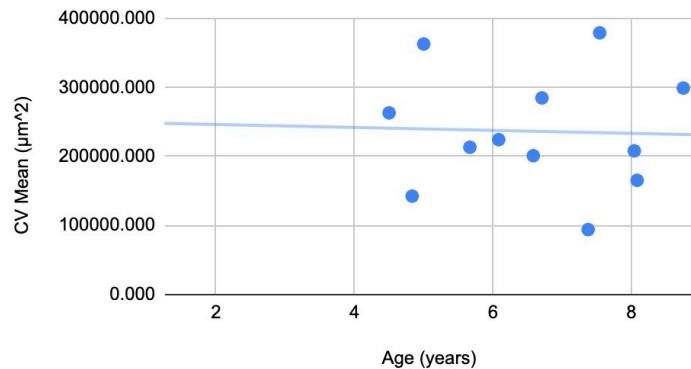
Results

Results

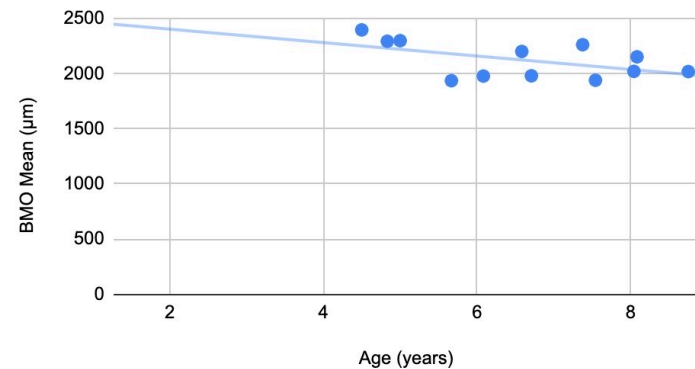
Age & Weight

- age and weight are **insignificant** in ONH parameters

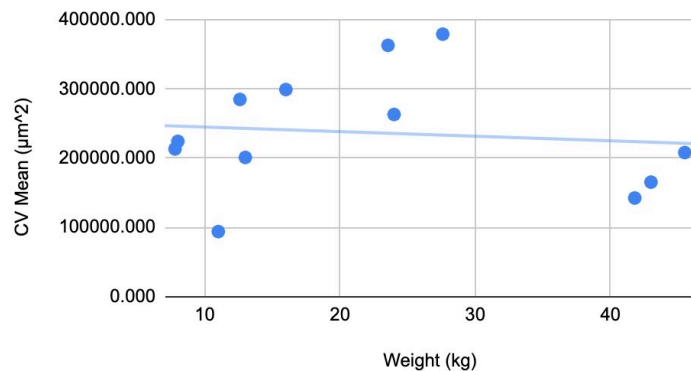
CV Mean (μm^2) vs. Age (years)



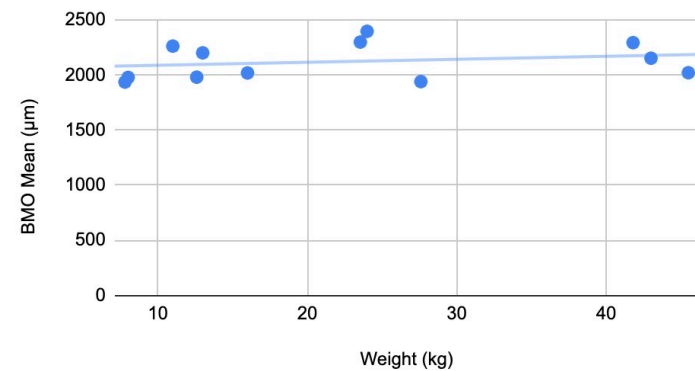
BMO Mean (μm) vs. Age (years)



CV Mean (μm^2) vs. Weight (kg)



BMO Mean (μm) vs. Weight (kg)

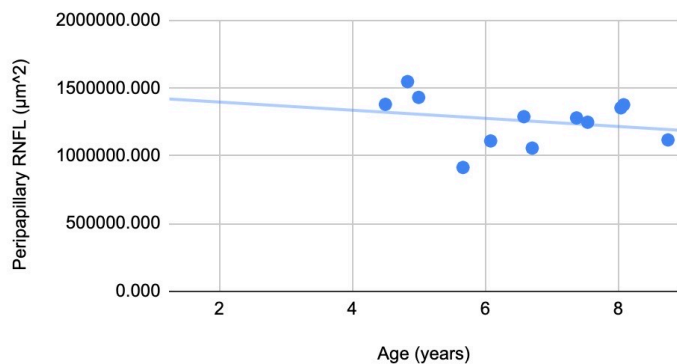


Results

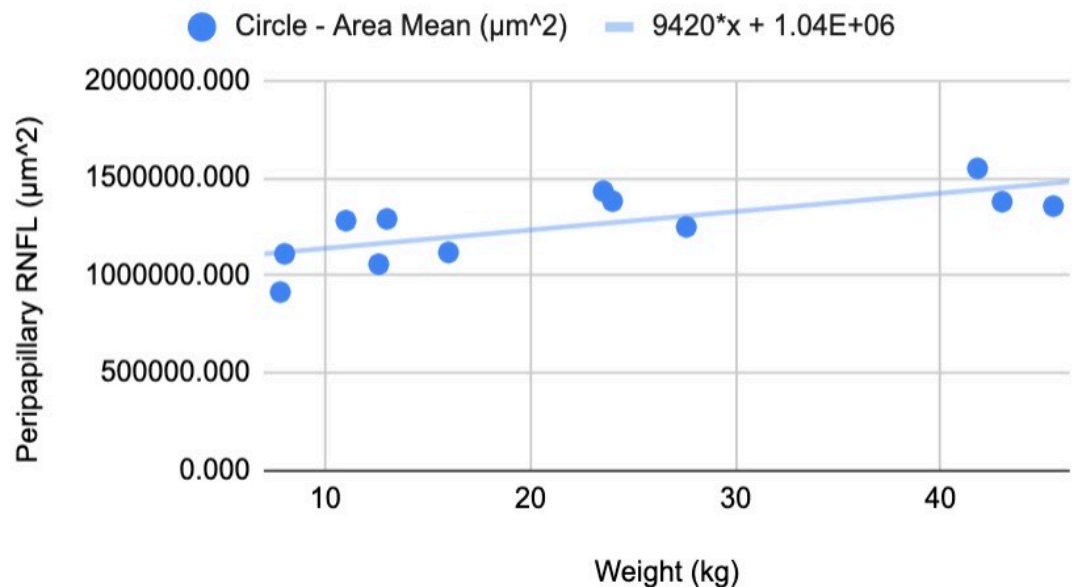
Age & Weight

- age and weight are **insignificant** in ONH parameters
- peripapillary RNFL trends with weight, but not age

Peripapillary RNFL (μm^2) vs. Age (years)

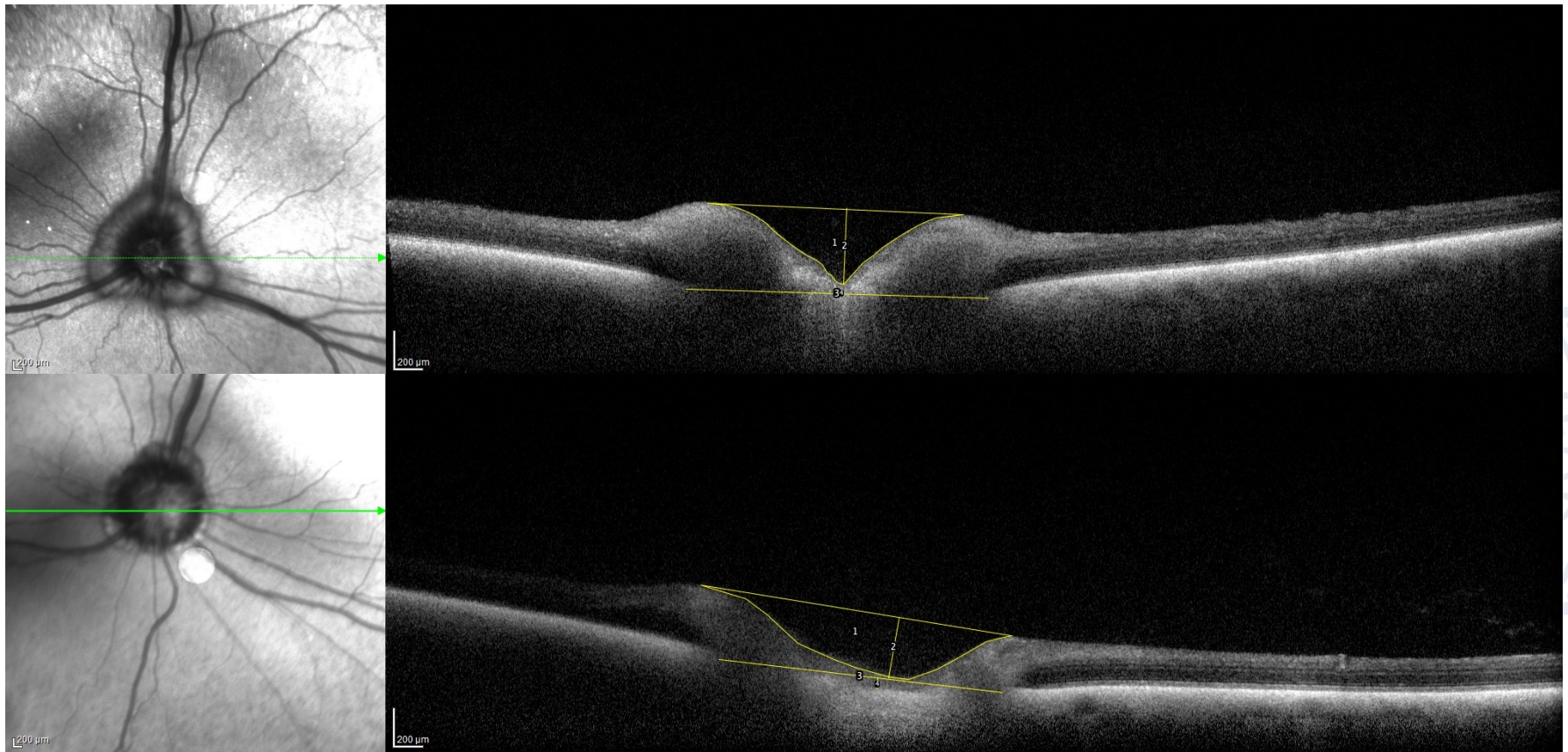


Peripapillary RNFL (μm^2) vs. Weight (kg)



Results

In normal canines, variation in the ONH and peripapillary RNFL is critically influenced by the differences in myelination between subjects.



Results

Measurements

- our method of measuring ONH and peripapillary RNFL parameters is repeatable, except LCD
- the most accurate value to use is MCD due to the low standard deviation and it can account for differences in myelination between patients

Parameter	Mean \pm SD
Peripapillary RNFL (μm^2)	1,259,472.5 \pm 179,698.8
CV (μm^2)	236,487.2 \pm 85,466.9
MCD (μm)	309.8 \pm 49.7
BMO (μm)	2,123.6 \pm 163.0
LCD (μm)	81.1 \pm 35.7

Future Outcomes



- Increasing the number of subjects
- Perform the same study on patients affected by or are predisposed to glaucoma to make comparisons
 - Specifically using MCD and peripapillary RNFL



Acknowledgements

- Thank you to **Dr. Soohyun Kim** for mentoring me throughout this project!
- Thank you to everyone in the **Comparative Ophthalmology Vision Sciences Research Lab** for helping me with my study this summer!
- Thank you to the **NIH Teaching Grant T35-OD010956** and the **Center for Companion Animal Health at the UC Davis Veterinary Medical Teaching Hospital** for funding our clinical study!





**Thank you for listening!
Questions?**