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

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Objective

This study aims to **establish reference ranges for measurements of the optic nerve head (ONH) and peripapillary retinal nerve fiber layer (RFNL) using optical coherence tomography (OCT) in normal canines** to monitor patients predisposed to or suffering from glaucoma and prolong vision.
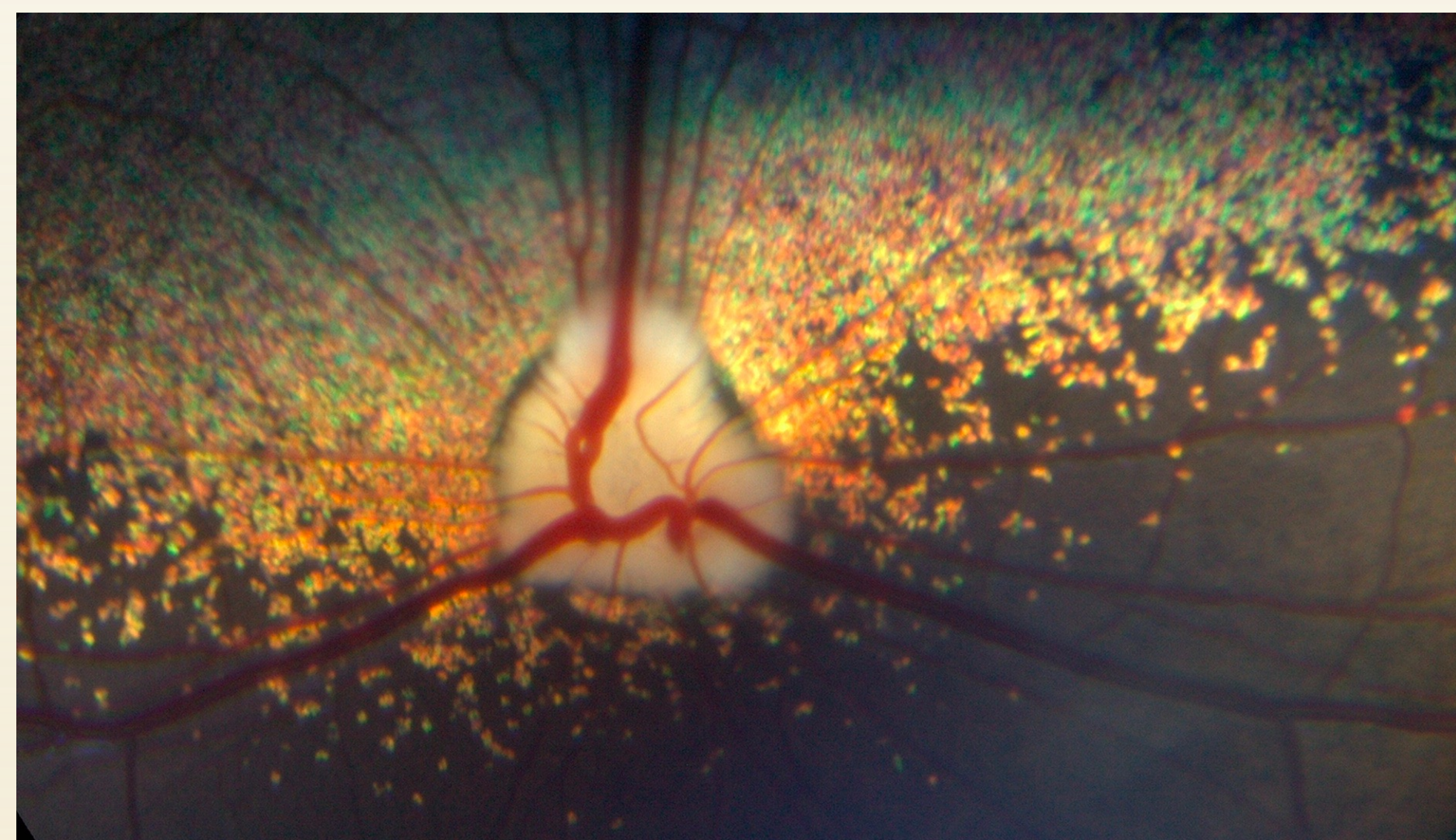
Figure 1 (above). Fundic photograph of the left eye of 6-year-old, 8-kg canine subject.

Introduction

Glaucoma
↑ intraocular pressure (IOP) → **pain** and irreversible damage to the optic nerve head (ONH) and retina → **blindness**

How to Control Glaucoma
timely diagnosis
frequent monitoring
consistent therapeutics

Optical Coherence Tomography (OCT)
- repetitive, non-invasive advanced imaging
- used in human medicine to monitor vision-threatening conditions
- detects changes in ONH and peripapillary (around the ONH) RNFL

Due to the anatomical differences of ONH and variations of peripapillary myelination between humans and dogs, the use of OCT with the automatic assessment function is **limited for canine patients.**

Methods

Subjects
12 healthy dogs (n=12; 6 males, 6 females)
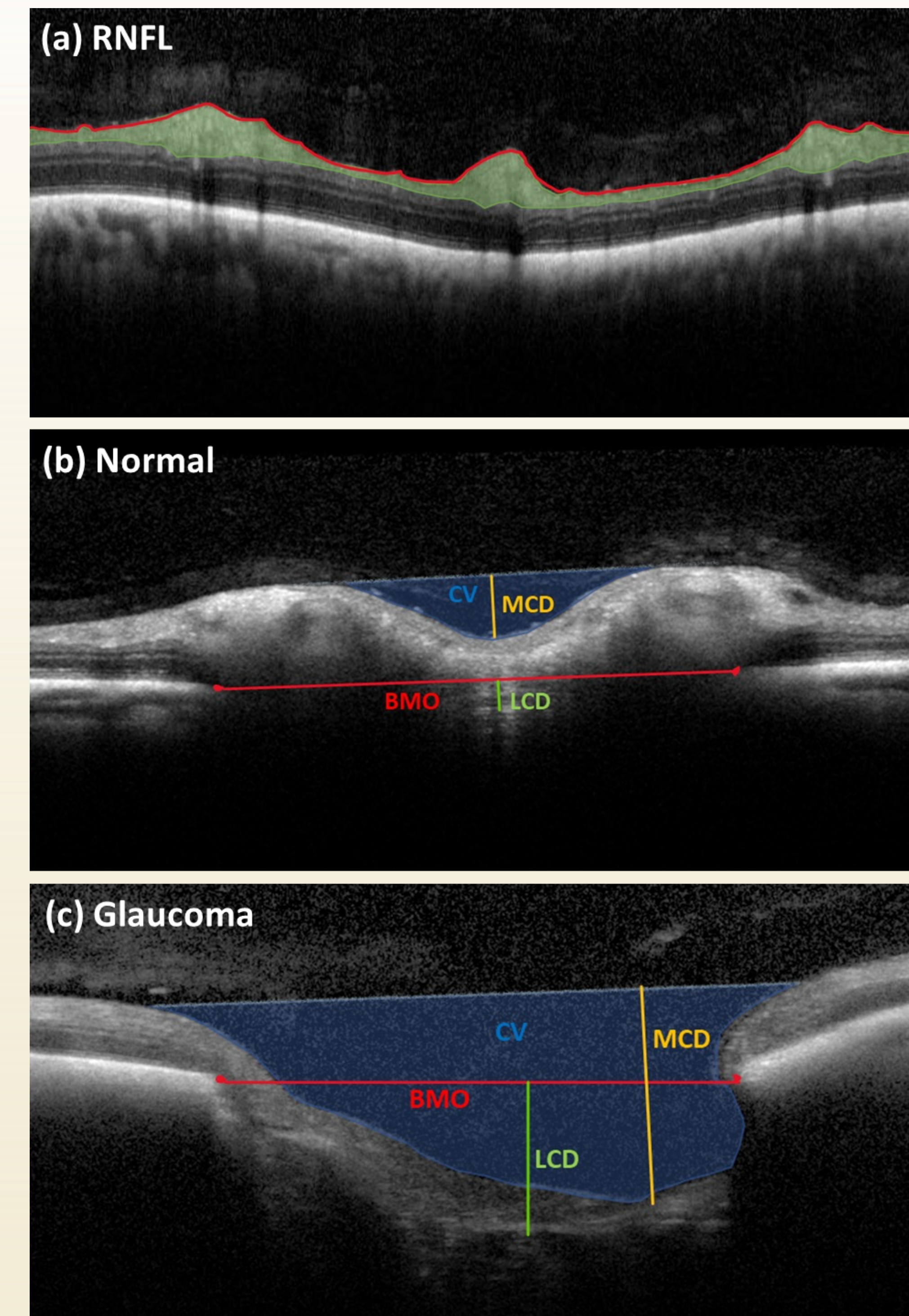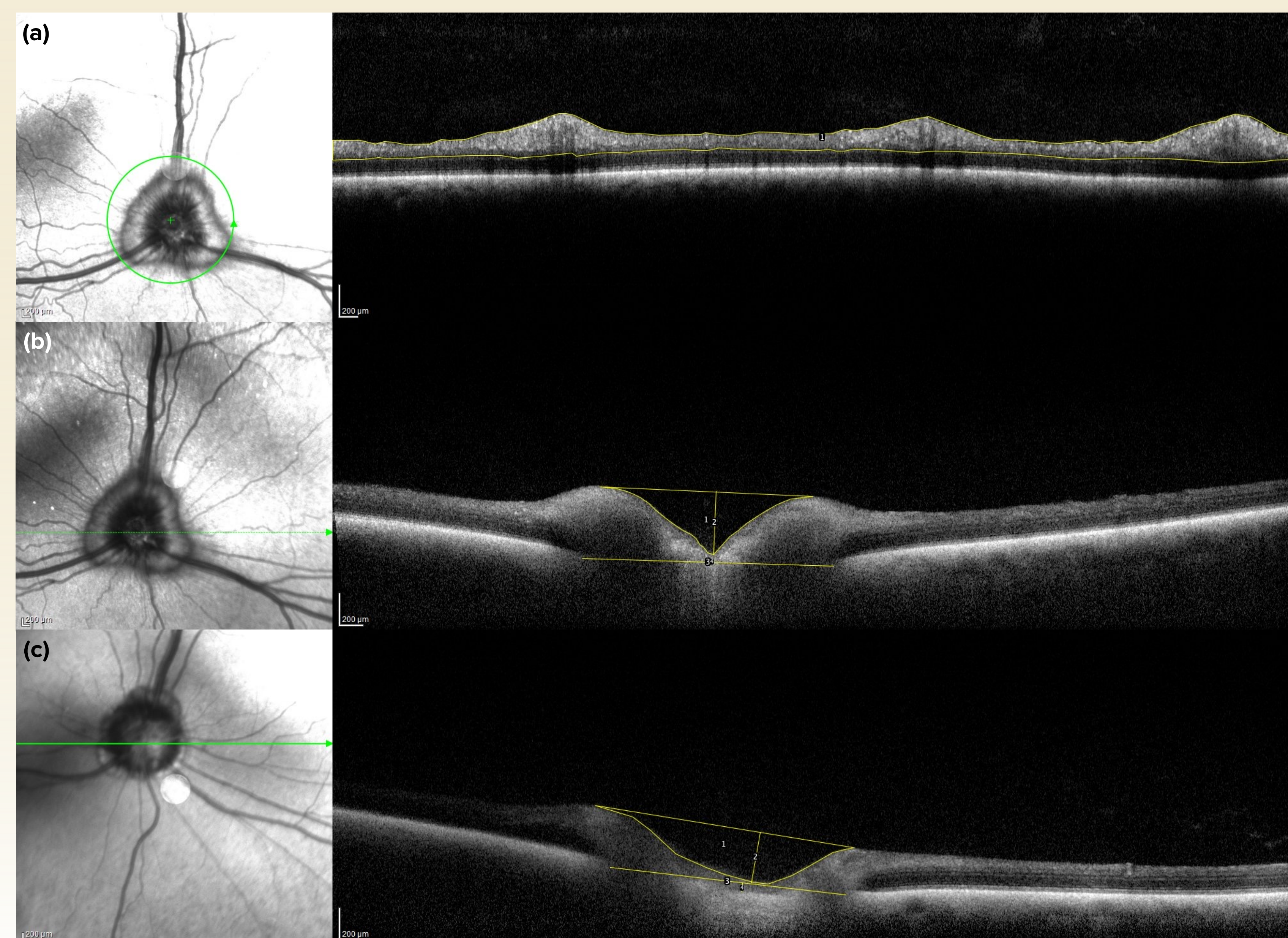4.5-8.75 years old (6.6 ± 1.4)
7.8-45.5 kg (22.8 ± 13.9)

Imaging
OCT (Spectralis®, Heidelberg Engineering)
near-infrared reflection (IR) and cross-sectional images of ONH and peripapillary RNFL

Measurements
peripapillary RFNL area
cup volume (CV)
maximum cup depth (MCD)
lamina cribrosa displacement (LCD)
Bruch's membrane opening (BMO)
measured using ImageJ

Figure 2 (right). ONH parameters in the cross-sectional OCT images of (a) peripapillary RNFL, and ONH in (b) normal and (c) glaucomatous eyes. (a) Green area = RNFL; Red line = inner limiting membrane (ILM), (b, c) MCD, orange line; and BMO, red line; LCD, green line; CV, blue area

Figure 3 (left). Spectral-domain OCT (Spectralis®) for the IR+OCT of circle (a) and line (b, c) scans of the peripapillary RNFL and ONH. (a) and (b) are from the same eye, with myelination. (c) is from a different subject, with less myelination.

Results

Measurements
- our method of measuring ONH and peripapillary RNFL parameters is repeatable, except LCD, which is only significant in patients with disease and had high standard deviation

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

Conclusions

In normal canines, variation in the ONH and peripapillary RNFL is critically influenced by the differences in myelination between subjects, not age or weight.

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

Table 1 (above). Quantification of ONH parameters and peripapillary RNFL using OCT in 12 normal dogs (n=12).
Data presented with mean ± standard deviation (SD). Google Sheets was used for statistical analysis.

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