

ALL ABOUT

TONOVET



TONOVET PRO

The premium tonometer
for fast and reliable IOP
measurements.

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icare **TONOVET**





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This handbook is for veterinarians, veterinary technicians, and animal care professionals who perform eye examinations and intraocular pressure (IOP) measurements in animals.

It is designed to provide guidance on using TONOVET tonometers effectively, understanding IOP, detecting ocular conditions such as glaucoma and uveitis, and implementing best practices in clinical and home monitoring settings.

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SETTING THE STANDARD IN VETERINARY TONOMETRY

Over 20 years of pioneering rebound tonometry for animal eye care

In 2003, the first rebound tonometer specifically designed for animals was introduced: the **original TONOVET**. This marked a shift in how intraocular pressure, IOP, could be measured in veterinary patients. With its ease of use, quick measurement process, and the ability to perform measurements without anesthesia, it offered a practical and animal-friendly solution.



2003

TONOVET

The first rebound tonometer for animals, enabling quick, anesthesia-free IOP measurement.



2017

TONOVET Plus

Improved model with species-specific settings for dogs, cats, rabbits, and horses.



The iCare story began with the invention of the rebound tonometer, a breakthrough in patient-friendly IOP measurement.

TONOVET tonometers are based on iCare's proprietary rebound technology, which has since become a widely accepted standard in IOP measurement, in both human and veterinary medicine. For over 20 years, iCare's tonometers have supported early glaucoma detection and routine eye pressure monitoring in a way that is both gentle on the patient and efficient for the user.

Over time, the TONOVET product family has grown and evolved alongside the needs of veterinary professionals. Each new device generation has introduced improvements in precision, usability, and species-specific accuracy, while continuing to uphold the core values established by the original TONOVET.

The TONOVET Plus, introduced in 2017, added separate settings for dogs, cats, rabbits, and horses, improving measurement accuracy across species. In 2024, the portfolio expanded with TONOVET Pro, a premium tonometer built for busy clinical environments, and TONOVET Pet, a user-friendly tonometer designed for pet owners to monitor IOP at home between clinic visits. These additions helped provide a more complete view of how patients' eye health develops over time.

Today, TONOVET tonometers are used globally in practices, research facilities, and universities to support accurate and repeatable IOP measurements, which is essential for managing ocular health in animals.



2024

TONOVET Pro

Premium tonometer for busy clinics, designed for fast and reliable IOP measurement.



2024

TONOVET Pet

User-friendly device for pet owners to monitor eye pressure at home.



THE ORIGINAL TONOVET

The beginning of a new standard

When it comes to intraocular pressure (IOP) measurement in animals, it's impossible to overlook the impact of TONOVET. The original rebound tonometer was a groundbreaking innovation that transformed daily veterinary practice. It allowed for faster, more accurate, and far less stressful IOP measurement.

TONOVET quickly became a pioneer in rebound tonometry.

Before the introduction of TONOVET, measuring IOP in animals was often complicated. It required local anesthetics, delicate techniques, and sometimes even sedation, all time-consuming and potentially stressful for the patient. The original TONOVET revolutionized the process by introducing a completely new method: rebound tonometry.

iCare TONOVET tonometers operate on a rebound principle, where a lightweight probe moves within a magnetic field. Based on the deceleration and rebound time, the device averages six readings to calculate the IOP. No anesthetics or calibration are required. The measurement takes just a fraction of a second and is barely noticeable to the animal.

The probe consists of a gold-plated metallic wire that allows proper movement and a small tip made of medical-grade plastic that gently touches the cornea. The probe's weight and straightness tolerances are precisely controlled to ensure accurate intraocular pressure (IOP) measurements.

The original device

The original TONOVET model, also known as TV01, was developed in Finland and launched in the early 2000s. The device was compact, portable, easy to operate, and entirely cordless. Clinicians quickly embraced it for its reliability, ease of use, and for how little it disturbed the animal.

The new device enabled accurate measurements on dogs, cats, horses, birds, and even exotic animals, often for the first time, without the need for sedation or topical anesthesia. It became a game-changer in the early diagnosis of glaucoma and other pressure-related ocular conditions.

The legacy of TONOVET

The TONOVET laid the foundation for everything that followed. Its core, rebound technology, remains the backbone of all TONOVET models to this day. Newer models have been built upon the original, offering advanced features like color display, positioning guidance, and a quick measure setting.

It is not only part of veterinary history; it is also part of the future. iCare brought rebound tonometry into the hands of veterinarians and introduced a gentle, effective way to measure IOP. While newer models have refined the concept, the original TONOVET reminds us of where it all began.



The measurement takes just a fraction of a second and is barely noticeable to the animal.

THE TONOVET PRODUCT FAMILY

An accurate, easy-to-use tonometer is a must-have device for every clinic.

iCare TONOVET rebound tonometers are quick and easy to use with species-specific settings for the unique characteristics of different animal eyes. Their use requires no anesthesia or calibration and our patented rebound technology ensures a user-friendly experience for both veterinary professionals and their patients.

TONOVET *Pro*

Our premium tonometer that offers faster IOP measurements. Its downward measuring capability and positional freedom enhance user ability and functionality. The Quick Measure feature is especially beneficial for challenging patients, as well as for novice users.

- + Improved usability and accuracy
- + 200-degree position freedom
- + Quick Measure option
- + Advanced probe control
- + Display facing the user
- + 3-year warranty

200 DEGREES OF
POSITIONAL FREEDOM



TONOVET *Plus*

A high-quality tonometer with standard features, suitable for veterinarians at all experience levels. The intelligent positioning assistant lights guide users to achieve the correct horizontal measurement angle, allowing for quick measurement execution.



TONOVET *Pet*

A cost-effective and user-friendly solution for monitoring IOP in pets from the comfort of their home. Designed with reliable rebound technology, this device ensures effortless and accurate measurements displayed in four ranges.

PERFECT FOR
HOME MONITORING



Device comparison

icare **TONOVET Pro**icare **TONOVET Plus**icare **TONOVET Pet**

<i>Intended Use</i>	Diagnosing	Diagnosing	Home monitoring and screening
<i>Settings</i>	Dog, Cat, Rabbit, Horse	Dog, Cat, Rabbit, Horse	Dog
<i>Measuring Angle</i>	200°	Horizontal ($\pm 10^\circ$)	Horizontal ($\pm 10^\circ$)
<i>Quick Measure</i>	Yes	No	No
<i>Alignment Assistant</i>	Yes	Yes	Yes
<i>Error Code Clearing</i>	No	Yes	Yes
<i>Probe Release Control</i>	Yes, even when the device is switched off	Yes, when the device is on	Yes, when the device is on
<i>Measurement History</i>	100 measurements with Date, Time, IOP result + Quality indication, Calibration setting, Measurement mode, Measurement angle	10 measurements with IOP result + Quality indication, Calibration setting	10 measurements with IOP result + Quality indication
<i>Weight with Batteries</i>	255 g	230 g	230 g
<i>Warranty</i>	3 years	2 years	2 years
<i>Power Supply</i>	4 x AA non-rechargeable batteries, 1.5V alkaline LR6		



Testimonial

Kanokpich Imcharoon
Veterinary Ophthalmologist
Panalai Veterinary Hospital

The **TONOVET Pro** has significantly enhanced our ability to diagnose and manage ophthalmic diseases in exotic and wildlife species. Its gentle, non-invasive approach makes it especially suitable for delicate and small-eyed patients. The multi-angle rebound tonometry allows for accurate IOP measurements even in challenging head positions, reducing the need for physical restraint and minimizing stress. It also enables efficient IOP assessment under anesthesia with minimal repositioning. Its lightweight and portable design makes it ideal for use in the field, allowing ophthalmic evaluations in free-ranging or immobilized animals. With the **TONOVET Pro**, we are now able to detect early signs of glaucoma and uveitis more confidently, leading to better clinical outcomes. It has become an indispensable tool in our exotic and wildlife ophthalmology practice.”

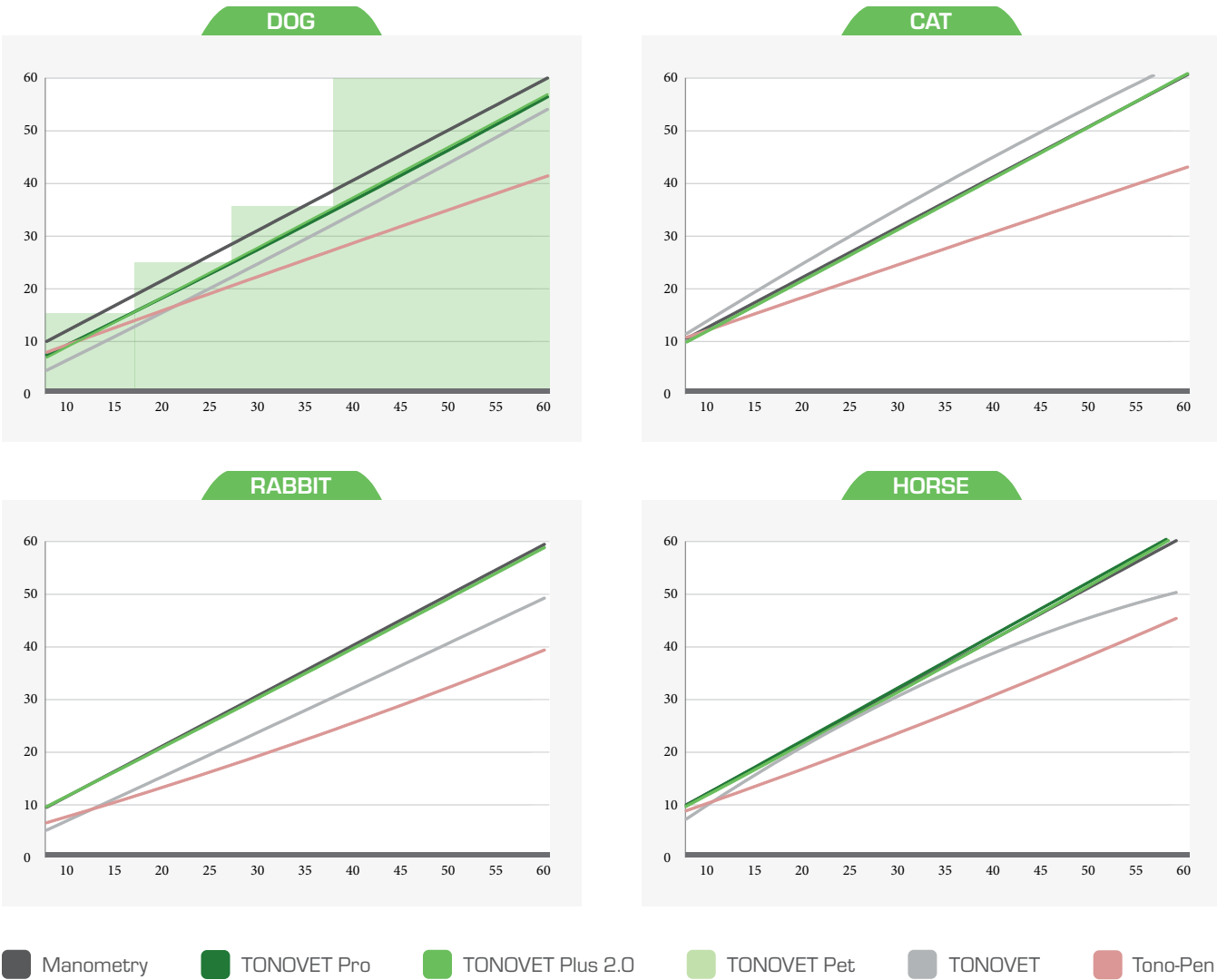
Species-specific settings assure accuracy and precision for every measurement.

Validated accuracy across species

iCare TONOVET rebound tonometers are quick, easy to use, and patient-friendly, requiring no anesthesia or calibration. iCare TONOVET tonometers have species-specific settings for the unique characteristics of animal-eyes. The accuracy of our tonometers has been validated by several independent studies*.

These four charts demonstrate that all TONOVET tonometers are calibrated for specific species to correlate with manometry testing, which accurately measures intraocular pressure.

**Measurements from rTVP (TONOVET Plus 2.0) and TVPR (TONOVET Pro) exhibited almost perfect agreement with the manometer. (Lee, J. et al. Veterinary Ophthalmology, 2025; 0:1–8.)*



Testimonial



Ron Ofri, DVM, PhD, DECVO
*Professor of Veterinary Ophthalmology
Hebrew University of Jerusalem, Israel*

TONOVET Plus

“Measuring intraocular pressure (IOP) is essential in veterinary medicine for the early detection and management of glaucoma, a potentially blinding condition. Elevated IOP can cause irreversible damage to the optic nerve, so timely diagnosis is critical to preserving vision. Monitoring IOP also helps detect uveitis, where decreased pressure may be an early clinical sign of another devastating disease.

Intraocular pressure measurements guide therapeutic decisions and allow veterinarians to evaluate treatment efficacy over time, and therefore a tonometer is an essential diagnostic instrument in every veterinary clinic, and not just specialty clinics.

“ Personally, I regard the TONOVET Plus as the best instrument for measuring IOP in my patients due to its accuracy, ease of use, and animal-friendly design.”

It requires no topical anesthetic, which may be harmful to the corneal epithelium. Its rebound tonometry technology is non-invasive and well-tolerated across species. The device features species-specific calibration settings, improving the reliability of results in dogs, cats, horses, and other animals. Its ergonomic design and digital display make it ideal for both general practitioners and specialists in high-volume or referral settings.

Owners appreciate being able to see real-time results, which makes explaining ocular conditions like glaucoma or uveitis much more straightforward. And if you work in a research center, I definitely recommend the TONOLAB, another rebound tonometer from iCare, which allows me to measure IOP in rodents with all of the advantages of the TONOVET Plus.”



TONOVET Pet

“TONOVET Pet has really revolutionized our lives, and our interaction with pet owners and general practices that own this rebound tonometer. Prior to its introduction, some pet owners would buy the TONOVET or TONOVET Plus to monitor intraocular pressure (IOP) in their glaucomatous pets. However, these were usually very anxious owners, who would call us endlessly, day and night, every time the pressure rose by 2, 3 mm Hg, even though such an increase has no clinical significance.

It got to a point where we would not recommend the instrument to owners who are especially nervous and apprehensive, because we knew that we will be hearing from them daily. And that these small and meaningless fluctuations will cause lots of anxiety to the owners themselves.

The TONOVET Pet changed all this. The brilliant concept of displaying a range of IOP means that owners no longer know if the pressure increased from 17 to 19 mm Hg, and therefore they do not call us with these updates. The owners themselves are also much more relaxed, because they see that the pressure remains in the same range over a long time. Now they call us only when the range changes, and when they really need our intervention. Thanks to the TONOVET Pet both we and the owners are much more relaxed, while still being able to manage the disease.” ■



UNDERSTANDING IOP AND TONOMETRY

Intraocular pressure (IOP) provides essential information about ocular health in veterinary patients. Reliable tonometry and informed interpretation of IOP measurements are central to the diagnosis and monitoring of conditions such as uveitis and glaucoma.

Intraocular pressure (IOP) is determined by the balance between aqueous humour production and drainage. It maintains eye shape, nourishes intraocular structures, and supports their function. Increased IOP results from impaired drainage, while decreased IOP may stem from reduced production or leakage due to trauma.

Tonometry measures IOP and is essential in evaluating ocular conditions. Every companion animal practice should have a reliable tonometer, such as a rebound tonometer (e.g., TONOVET) or an applanation tonometer (e.g., Tonopen). IOP readings must be interpreted alongside clinical signs and compared with the fellow eye.



Treatment for glaucoma aims to reduce IOP medically or surgically. Neuroprotective agents may help preserve vision. Despite treatment, glaucoma has a guarded prognosis. In primary glaucoma, the unaffected eye should be closely monitored and treated preventively.

High IOP

OCULAR HYPERTENSION (GLAUCOMA)

Glaucoma is most often caused by obstructed aqueous outflow. Primary glaucoma, often breed-related, involves abnormal iridocorneal angle development and typically affects both eyes in middle-aged dogs. Secondary glaucoma may result from tumors, synechiae, or inflammatory blockage.

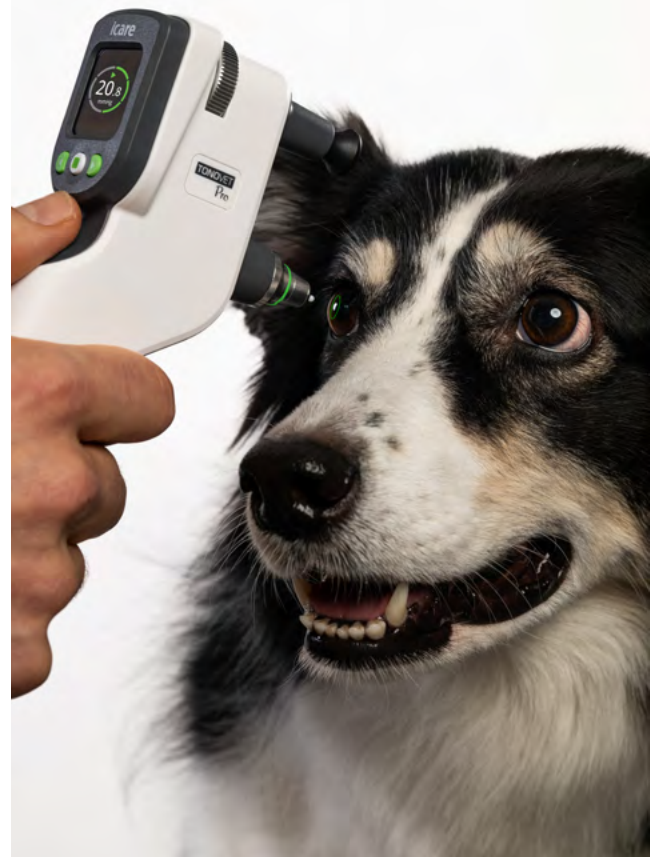
Early signs of glaucoma include serous discharge, blepharospasm, vessel hyperemia, mydriasis, and sluggish pupillary reflexes. Advanced signs include pain, corneal edema, buphthalmia, optic disc cupping, retinal degeneration, and even blindness.

Low IOP

OCULAR HYPOTENSION

The most common cause of ocular hypotension, or low IOP, is uveitis, an intraocular inflammation. Acute anterior uveitis causes pain, photophobia, and blepharospasm. Affected eyes are red, with corneal edema, a swollen iris, and a miotic pupil. Fibrinous exudate may lead to posterior synechiae and secondary glaucoma. Posterior uveitis may cause retinal detachment or chorioretinitis.

A full diagnostic work-up is essential, as uveitis may be linked to systemic disease. Treatment includes anti-inflammatories, mydriatics, and antibiotics when needed. IOP should be monitored throughout treatment and therapy should continue until IOP normalizes.



Factors that may influence IOP

- Older and debilitated animals tend to have lower IOP.
- Stress and firm restraint can cause elevated IOP.
- Chronically elevated IOP may cause buphthalmia, which persists even after pressure normalization.
- Regular IOP monitoring is crucial during treatment for uveitis, glaucoma, or both.

Critical IOP thresholds

- 30 mmHg for several days damages the optic nerve and retina.
- 40 mmHg causes pain and globe enlargement.
- 40–50 mmHg may paralyze the iris sphincter.



MEASURING INTRAOCULAR PRESSURE (IOP) IN PRACTICE

Simple guidance for accurate
and reliable tonometry

*Dr. Dan Wolf, DVM, ACVO Diplomate
Southern Eye Clinic for Animals, Tampa, Florida*

Whenever a patient's eye is abnormal, intraocular pressure (IOP) is an important piece of data in determining the pathology in the eye. Only with this information can we correctly assess ophthalmic condition and formulate a plan for therapy.

In identifying the correct treatment plan, it is important to first assess whether IOP is **above** normal or **below** normal and if the pressures in the two eyes are nearly equal. Based on the appearance of the eye, is the pressure higher or lower than one would expect?

For this, every veterinarian needs a reliable tonometer.

The ideal tonometer is one that is easy to use, gives quick, accurate and reproducible results, is durable and

requires minimal maintenance. The iCare TONOVET tonometers fit this description well. Rebound tonometry is based upon the principle of an object bouncing off a firm surface returning faster than the same object bouncing off a soft surface. In the case of TONOVET, a small piece of plastic is attached to a metal pin (= probe) that is magnetically propelled against the cornea and that returns through the magnetic field. The speed of return is proportional to the intraocular pressure and is converted to a digital readout in mm of mercury.



When using TONOVET, there are a few principles to remember to achieve accurate and replicable results:

STEP 1: Ensuring correct positioning

- + The tonometer pin should be parallel to the floor and positioned perpendicular to the corneal surface.
- + The distance from the tip of the pin to the cornea should be approximately 4-8 mm.
- + Position the patient's head so that the eye to be measured is looking directly forward, not up or down, nor right or left.
- + Steady your measuring hand against the patient's head or the other hand on the patient's head.
- + Place the tonometer near the eye, allow a few seconds for the patient to adapt to the situation. This minimizes the menace response or "fright" blinking.
- + Monitor the position and orientation of the tonometer and the pin in relation to the cornea.

STEP 2: Taking the measurement

- + Always measure the eye pressure as close to the middle of the cornea as possible. Do not try to view the display at the same time.
- + When the distance between the bead and the cornea is as desired and the eye position and probe alignment are correct, press the measuring button. A single beep tone indicates successful reading.

“ With regular practice, the TONOVET tonometer will be a joy to use and become an invaluable addition to your veterinary practice. By paying careful attention to patient handling, positioning, and timing you can greatly improve measurement reliability.

“

Careful patient handling,
correct positioning,
and proper timing are
essential for reliable IOP
measurements.”

– Dr. Dan Wolf, DVM, ACVO
Diplomate Southern Eye Clinic
for Animals, Tampa, Florida



Key tips for successful IOP measuring

- + The patient should be as relaxed as possible and subject to as little restraint as necessary.
- + The head and neck should be oriented in the straight-ahead position with no tension (up, down or sideways) in the neck.
- + Avoid any pressure on the ventral portion of the neck as this can partially occlude the jugular vein and increase intraocular pressure.
- + Allow the patient for a few moments to acclimate to the presence of the instrument so that the eye is not retracted into the orbit.
- + Apply no more traction to the eyelids than necessary to hold them open.
- + Minimize distractions in the room as the patient's eye movements also temporarily increase intraocular pressure.
- + Try to trigger the measure button when the eye is centrally oriented and not moving.
- + Always measure both eyes so their data can be compared and accurately interpreted in formulating a diagnosis.

An unhurried technique and small details in handling patients make a big difference in **reliable results**.

CLINICAL INDICATIONS FOR IOP MEASUREMENT

David A. Wilkie, DVM, MS, DACVO
Ohio State University

Breeds predisposed to primary glaucoma should receive annual IOP monitoring.

Determining intraocular pressure (IOP) is indicated in all blind or buphthalmic eyes and eyes with episcleral congestion, diffuse corneal edema, anisocoria, lens luxation, anterior uveitis, or fixed and dilated pupils. In addition, animals with medically or surgically managed glaucoma require sequential IOP evaluation to confirm adequate control.

Animals with documented primary (breed-related) glaucoma require routine IOP monitoring in both the affected and unaffected (i.e., at risk) eyes. In dogs and cats, normal IOP values are between 10 and 20 mmHg; elevated IOP is indicative of glaucoma.

FELINE BREEDS

- Persian
- Siamese
- Domestic Short Hair

CANINE BREEDS

- Afghan
- Akita
- Alaskan Malamute
- American Eskimo Dog
- Australian Cattle Dog
- Basset Hound
- Beagle
- Bedlington Terrier
- Bichon Frise
- Border Collie
- Boston Terrier
- Bouvier des Flanders
- Brittany
- Bullmastiff
- Cairn Terrier
- Cardigan Welsh Corgi
- Chihuahua
- Chow Chow
- Cocker Spaniel
- Dachshund
- Dalmatian
- Dandie Dinmont Terrier
- English Cocker Spaniel
- English Springer Spaniel
- Entlebucher Mountain Dog
- Flat-coated Retriever
- Fox Terrier (all varieties)
- Golden Retriever
- Great Dane
- Greyhound
- Irish Setter
- Italian Greyhound
- Keeshond
- Labrador Retriever
- Lakeland Terrier
- Maltese
- Manchester Terrier
- Miniature Pinscher
- Newfoundland
- Norfolk Terrier
- Norwegian Elkhound
- Norwich Terrier
- Pekingese
- Pembroke Welsh Corgi
- Petit Basset Griffon Vendéen
- Poodle (all varieties)
- Pug
- Saluki
- Samoyed
- Schnauzer (all varieties)
- Scottish Terrier
- Sealyham Terrier
- Shar Pei
- Shiba Inu
- Shih Tzu
- Siberian Husky
- Skye Terrier
- Tibetan Terrier
- Welsh Springer Spaniel
- Welsh Terrier
- West Highland Terrier



COMMON MISTAKES WHEN MEASURING IOP

The importance of accurate and reliable tools for efficient diagnosis

Intraocular pressure (IOP) measurement is an integral part of the complete ophthalmologic examination and is critical to the diagnosis and management of uveitis and glaucoma. Several methods of IOP measurement have been used in veterinary patients.

Choosing the right tonometer

The rebound tonometer has been a reliable and convenient veterinary tonometer for over 20 years and, unlike indentation or applanation tonometers, does not require topical anesthesia. When dealing with any patient affected by ocular disease, veterinarians should conduct a minimum ophthalmic assessment. This includes evaluating the menace response, direct and consensual pupillary light reflexes, performing the Schirmer tear test, using fluorescein stain, and measuring IOP.

Measuring IOP is crucial for assessing any red eye, as well as for all painful, cloudy, or blind eyes; eyes with fixed and dilated pupils; patients exhibiting anisocoria; those with cataracts or uveitis; and breeds that are predisposed to glaucoma.

Failure to have a reliable means of measuring IOP does not align with modern practice standards. Vision can be quickly and easily lost due to commonly encountered ophthalmic diseases that can affect IOP, such as uveitis, glaucoma, lens luxation, and cataracts. Therefore, accurately diagnosing vision-threatening conditions and initiating prompt, appropriate treatment for IOP abnormalities is vital for preserving a patient's vision and ensuring ocular comfort.

Patients are often referred to veterinary ophthalmologists for an ocular condition that has been misdiagnosed because tonometry was not performed or because incorrect technique led to inaccurate IOP values. By avoiding these mistakes, veterinarians can proactively improve patient care.

ENSURING CORRECT HANDLING OF PATIENTS

Proper patient handling is essential for obtaining accurate IOP measurements. Even minor restraint or head misalignment can significantly affect results. These guidelines will help ensure reliable measurements while maintaining patient comfort.

AVOID EXCESSIVE RESTRAINT

Excessive restraint of the patient and/or pressure on the eyelids can increase the IOP significantly. If a collar is worn; make sure it is not too tight or remove the collar for measurement.



MAINTAIN A NATURAL HEAD POSITION

The patient's head should be held as gently as possible on a natural, straight forward looking position – not tilted up, down or sideways. Be careful not to put pressure on the neck or eyeball/eyelids.



ADJUST YOURSELF, NOT THE PATIENT

A common user error is adjusting the patient's head during measurement. Even a slight tilt can increase IOP. The measurer should instead change their own position so the patient's head remains facing straight forward.



For additional guidance, watch the instructional videos on the TONOVET YouTube channel @tonovettonometers



Noticing a red eye?

PREVENTING GLAUCOMA WITH IOP MEASUREMENT

Many eye problems in pets are often manifested as a “red eye.” Measuring intraocular pressure (IOP) is an essential component of assessing ocular health. High IOP, low IOP, or significant differences in pressure between the two eyes can be the only clinical indicators of serious eye disease, particularly in breeds predisposed to glaucoma.

Glaucoma is a common blinding disease

Glaucoma is a prevalent eye condition that can lead to blindness in pets. The signs of glaucoma can be subtle and may resemble other eye problems. Look for symptoms such as squinting, prominent nictitating membranes, redness, a cloudy cornea, excessive tearing, dilated pupils, or vision loss. Early detection is crucial to minimize irreversible damage and prevent blindness and severe pain. Incorporating the use of a tonometer into routine examinations can significantly help in preserving a pet's vision.

Detecting and treating glaucoma

Glaucoma, increased pressure in the eye, can quickly damage the optic nerve and lead to vision loss. It may also develop gradually, resulting in vision deterioration with only a few noticeable clinical signs. Early detection through tonometry is crucial for managing and controlling glaucoma effectively.

IOP should be measured from:

- + All red eye patients
- + Young patients to establish baseline readings
- + Patients older than 6-7 years
- + Breeds predisposed to glaucoma
- + Ocular examination patients
- + Head trauma patients
- + Wellness plan patients



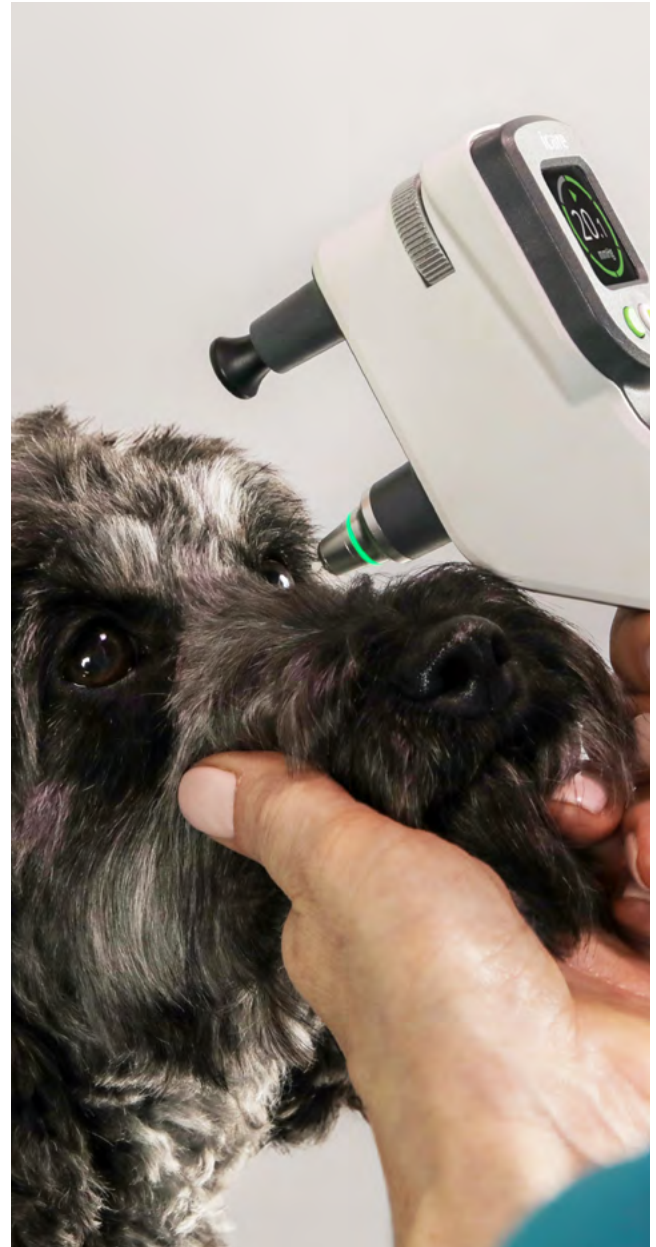
When Morris one evening became very agitated and clawed at his right eye, the pressure in the affected eye had already risen to dangerous levels.

A typical case of missed glaucoma

The importance of early detection for effective treatment

Symptoms of glaucoma are subtle and often mimic other eye diseases. When Morris one evening became very agitated and clawed at his right eye, the pressure in the affected eye had already risen to dangerous levels. Morris had presented with a bloodshot, runny eye for several months and was initially diagnosed with conjunctivitis by Rosalie Palmer, DVM. “Morris was treated three different times with eye drops, but the problem kept returning,” says owner Ulrika Lindfors-Davis. “Then one day the symptoms suddenly became much worse. It was clear he was in much pain, and we all had a restless night.”

*Every year, many dogs lose vision in one or both eyes due to sudden onset of glaucoma. **Morris**, a Bouvier des Flandres, is one of them.*



Glaucoma is commonly misdiagnosed

Palmer says she immediately suspected **glaucoma**, but was unable to confirm the diagnosis at the time because no tonometer available. She explains that early diagnosis of glaucoma is critical to avoid irreversible damage that can lead to blindness and pain. Early detection also improves the prognosis for retaining vision. “All dogs and cats presenting with red eyes of unclear origin should have their intraocular pressure measured, particularly breeds predisposed to glaucoma.” Other signs warranting immediate IOP measurement include a dilated pupil, enlargement of the eye, corneal cloudiness, excessive tearing, visual impairment, or head or eye trauma. The use of a tonometer such as TONOVET in regular checkups in breeds predisposed to glaucoma and in elderly dogs can make a significant difference in saving a pet’s vision.

Elevated eye pressure reveals glaucoma

After a few weeks, Palmer received a TONOVET tonometer and was able to confirm the diagnosis. “The lightweight probe did not even make Morris blink,” Ulrika says. “I was relieved that the procedure was so easy and pain free.” The first reading was available within seconds. “The eye pressure in the healthy eye was 14 mmHg, which is normal,” Palmer explains, “but the pressure in the affected eye was close to 50 mmHg, which would certainly have caused significant pain.” Normal eye pressure in dogs and cats ranges from 10-20 mmHg, while pressures over 25 mmHg are considered glaucoma. An eye with an IOP above 50 mmHg is, in almost all cases, irrevocably blind. Subsequent measurements revealed that the pressure in Morris’ right eye never went below 45 mmHg.

“It was evident that the vision in Morris’ right eye was not going to return.

Even with increased medication, an eye pressure this high is painful. Humans with glaucoma often describe the pain as an excruciating constant headache or migraine. Dogs and cats often show this discomfort by rubbing their eye with a paw or against the floor, by exhibiting decreased activity and less desire to play, irritability or decreased appetite. The pain fluctuates with the pressure in the eye, which will



increase and decrease due to various circumstances.

“It was evident that the vision in Morris’ right eye was not going to return and he was diagnosed with chronic glaucoma,” Palmer says. “We don’t know if Morris’ healthy eye will eventually develop glaucoma,” Ulrika adds, “but if it does, we know that the prognosis will be much better and that we can begin treatment as soon as possible, thanks to regular checkups with the TONOVET tonometer.” ■



Testimonial

*Dr. Anne-Marie J. Verbruggen, DVM, ECVO Dip.
EYES Oogheekundekliniek voor Dieren*

“Measuring the IOP is an intrinsic part of any eye examination, certainly when faced with a congested sclera, corneal edema, sluggish PLR and as a standard in breeds susceptible to increased IOP due to their genetic background. IOP measurement is key to an effective glaucoma treatment as well as uveitis treatment and in case of a glaucoma patient, it should be performed on a regular base throughout the life of the patient, as the disease is progressive.

With the TONOVET from iCare, the measurement is quick, easy and accurate and can be repeated frequently as it doesn’t require a local anesthetic, detrimental to the ocular surface. In the clinic, the nurses can perform the measurement without the ophthalmologists for patients on long term hypotensive drops. This allows the clinic to monitor the treatment without the costs (and time slot) of a regular check up. This is a win-win situation for both patient and the clinic!”

DIAGNOSING UVEITIS WITH TONOMOMETRY

Decreased intraocular pressure is one of the earliest indications of uveitis, caused by reduced aqueous humor production, breakdown of the blood aqueous barrier, and increased uveoscleral flow. The degree of this reduction varies depending on the duration and severity of uveitis.

The most common ocular signs in anterior uveitis include conjunctival hyphemia, aqueous flare, miosis and pain (lacrimation, blepharospasm and photophobia). Other typical findings may include hypopyon, hyphemia, ciliary flush, corneal edema, synechia and iris color change. In chronic uveitis, cataract formation, lens luxation (especially in cats) and secondary glaucoma may also be noted.

In posterior uveitis, vitreous opacity, retinal and choroidal changes, and decreased vision are common findings. Anterior uveitis can also develop secondary to other ocular diseases such as corneal ulcers, glaucoma or cataracts. A complete ophthalmic examination is therefore essential to differentiate between primary and secondary uveitis.



Factors influencing IOP measurements

Multiple factors can affect tonometric readings. A difference of more than **5 mmHg** in IOP between the two eyes should be considered significant, even if the values themselves fall within normal ranges. Low IOP readings may be a normal finding in the absence of any clinical signs of anterior uveitis, particularly in geriatric patients. Circadian rhythm can influence IOP measurements in both cats and dogs, with late-afternoon readings often lower than those obtained in the morning or at night. Although uveitis is typically associated with low IOP, high IOP can also occur. Secondary glaucoma is a common complication of severe uveitis.

Changes in corneal thickness due to scarring, pigmentation, or vessels from chronic corneal inflammation can cause falsely elevated IOP readings. Because of this, measurements should be taken from the most normal part of the cornea whenever possible. Proper head positioning is essential, as IOP tends to rise if eyelid manipulation or physical restraint (pressure of jugular veins or tight collar especially in brachycephalic dogs) is excessive. Sedation can also cause changes in IOP values.

For reliable interpretation, the examiner should remain consistent when recording IOP values with respect to the instrument used, time of day, head and body positioning, method of restraint, and use of sedation. A complete ophthalmic examination (and clinical examination) is very important when diagnosing ophthalmic diseases like uveitis. Tonometry is an essential part of this. ■



MEASURING IOP AT HOME

The benefits of home monitoring for your patients

TONOVET tonometers can be used to quickly and easily monitor the eye health of pets from the comfort of home. The discreet measurement is non-invasive, enabling better care for patients and easier monitoring for pet owners.



Home monitoring helps ensure comprehensive patient care.

Pet owners can actively participate in managing their pet's eye health, working closely with veterinarians to ensure the best care possible. Some eye conditions in pets that can benefit from home monitoring include:

- + Glaucoma
- + Cataracts
- + Goniodysgensis
- + Post-Op Gonioimplantation
- + Post-Op Phacoemulsification
- + Post-Op Cyclocryotherapy
- + Diode Laser Cyclophotocoagulation

Monitoring both short-term and long-term conditions is important, as IOP can fluctuate throughout the day.

Dr. Saito, head of Triangle Animal Eye Clinic in Tokyo, Japan, is a pioneer in IOP home monitoring. He manages a program with over 60 TONOVET devices available for lease. “We recommend this service primarily after glaucoma surgery, but also in some cataract cases or when patients are on long-term medication. We always ensure the owners are able to use the device properly.”

TONOVET *Pet*

A user-friendly solution for monitoring intraocular pressure (IOP) in pets from the comfort of their homes.



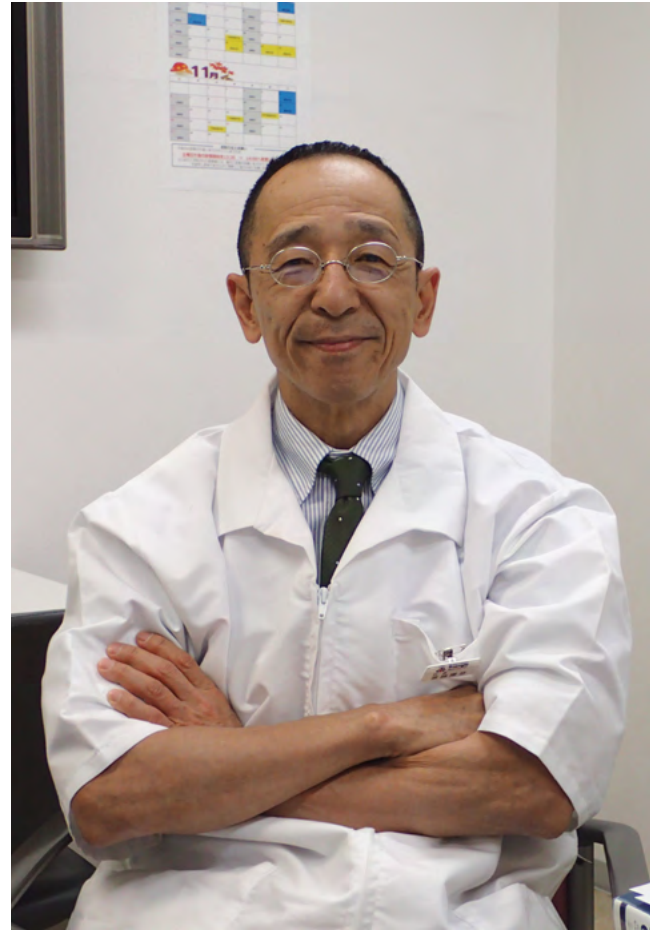
TONOVET *Plus*

A high-quality tonometer with standard features, suitable for veterinarians of all experience levels.



How to start home monitoring for your patients:

- 1 Patient requires IOP monitoring.
- 2 Pet owner agrees to lease the device from their veterinarian.
- 3 Owner receives training on how to use the device from their veterinarian.
- 4 Owner monitors IOP at home and reports results to the veterinarian according to instructions.
 - + Fast, gentle measurements
 - + No anesthetic required
 - + Easy and stress-free
 - + Real-time data



“ When our dog suddenly lost one eye and nearly went blind in the other, it was a huge shock. Thankfully, our vets saved it. Being able to now measure our dog’s IOP at home has greatly improved our lives and eliminated stress. His quality of life is just as good, if not better, because of all the affection and praise he gets for good behavior, especially during IOP checks. Having a TONOVET at home has been incredible. The device is user-friendly, with lights to guide positioning, and it takes readings automatically with just a button press.

I can’t recommend it enough.



While patients are closely monitored during hospitalization, it remains vital to continue monitoring IOP after they go home. At-home tonometry allows us to detect pressure changes that might otherwise go unnoticed.”

Insights from Dr. Gemma Turner

Dr. Gemma Turner, BSc DVM MANZCVS (SAIM) FANZCVS (ophthalmology) MRCVS Specialist in Veterinary Ophthalmology, Optivet South London

At-home intraocular pressure (IOP) monitoring is becoming an increasingly important part of managing ophthalmic patients in veterinary medicine. To better understand how this approach works in practice from a doctor’s point of view, we spoke with **Dr. Gemma Turner** about her clinic experience using TONOVET tonometers both in clinic and at home.

Building confidence for at-home monitoring

According to Dr. Turner, at-home IOP monitoring has been recommended at the clinic for several years. During that time, they have developed clear protocols to ensure both safety and reliability. “We always begin with an



introductory consultation,” she explains. “This gives owners the opportunity to learn how to use the tonometer correctly and understand when they should contact us for advice.” In the clinic, the team uses the TONOVET Plus tonometer, while for home use, patients are provided with either the TONOVET Plus or TONOVET Pet depending on their individual monitoring needs.

Supporting patients beyond the clinic

Dr. Turner emphasizes that the decision to introduce at-home monitoring was driven by the need for better long-term follow-up, especially in surgical glaucoma cases. “We offer glaucoma surgery, and while patients are closely monitored during hospitalization, it remains vital to continue monitoring IOP after they go home,” she says. “At-home tonometry allows us to detect pressure changes that might otherwise go unnoticed.” This extended monitoring can play a critical role in identifying early complications and improving overall outcomes.

When asked which patients benefit most from at-home monitoring, Dr. Turner highlights post-surgical glaucoma cases as the primary group. “These are the most common patients we send home with tonometry devices,” she notes. “However, we also see owners of patients who have lost one eye to primary closed-angle glaucoma choosing home monitoring to help plan timely intervention for the remaining eye.”

Real world use and client engagement

The duration of at-home monitoring varies depending on the case. “Typically, clients use the device for the first few months following surgery, but in some cases, monitoring may continue indefinitely,” Dr. Turner explains. Clients are actively involved in the process by recording measurements in a spreadsheet, including IOP values, timing, and medication schedules, and sharing this information with the clinic via email. “The frequency of reporting really depends on how stable the patient is,” she adds. “It’s always tailored to the individual case.”

Training is a key part of successful at-home monitoring. At Dr. Turner’s clinic, both veterinary ophthalmologists and nursing staff are involved in guiding pet owners. “Most owners are a little nervous at first,” she says. “But the ease of use of the device means they usually become confident and start getting reliable within a few days.”



Improving care and owner peace of mind

Dr. Turner believes that at-home monitoring significantly enhances patient care. “It allows for more regular monitoring and enables us to intervene more quickly when needed,” she explains. “This can minimize discomfort for the patient and improve surgical success.” She also notes the positive impact on pet owners: “Many owners feel more at ease knowing they can actively monitor their pet’s condition at home.”

Based on her experience, Dr. Turner and her team consistently recommend TONOVET rebound tonometers for IOP measurement. “We use them for all our patients,” she says. “They are reliable, easy to use, and an essential part of both in-clinic and at-home care.” ■



Testimonial

Mia Okura & Hiro

“Our experience with TONOVET tonometers has been truly life changing. Home monitoring has been absolutely essential for us, as our dog Hiro, a Shiba Inu, has a very typical case of glaucoma that requires close and consistent follow-up.

Measuring IOP at home has allowed us to obtain more accurate and reliable readings, as Hiro feels safe and relaxed in his familiar environment. This has made a significant difference compared to clinic measurements, where stress can easily affect the results.

Most importantly, home monitoring has brought us immense peace of mind. Knowing that we can track Hiro’s condition without constant clinic visits has greatly improved our quality of life as pet parents. The reassurance that comes with reliable, stress-free measurements at home is truly invaluable.”



A VETERINARY TEACHING HOSPITAL PERSPECTIVE

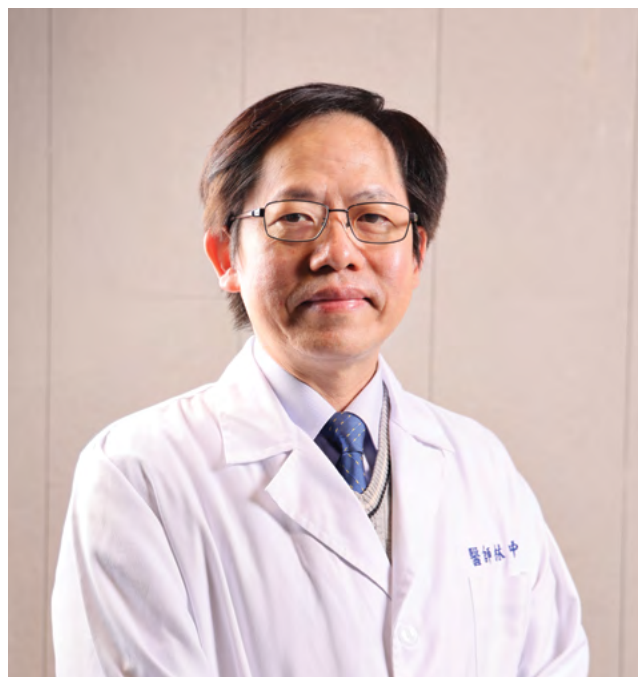
The importance of accurate IOP measurement in clinical practice and teaching

Prof. Chung-Tien Lin, DVM, PhD, Diplomate AiCVO

Director of the Institute of Veterinary Clinical Sciences, School of Veterinary Medicine, National Taiwan University. Head of Ophthalmology Service, National Taiwan University Veterinary Hospital

Accurate measurement of intraocular pressure (IOP) is essential in veterinary ophthalmology. Whether it is for early detection of glaucoma, differentiation of uveitis, or postoperative monitoring in animals, reliable IOP data is indispensable.

The iCare TONOVET Plus is the tonometer I frequently use in both teaching ophthalmology and clinical practice. Its operation is simple, straightforward, requires no corneal anesthesia, and is friendly for both animals and users. The TONOVET Plus features automated measurement, four species-specific modes, and an alignment aid light, making it especially useful for beginners. The overall measurement process is fast and stress-free, and it greatly improves clinical efficiency while minimizing patient discomfort.



Value of IOP measurement

Red-eye evaluation

IOP measurement is critical in differentiating causes of red eye. Abnormally high or low IOP readings may be the only clue to serious ocular diseases.

Early detection and monitoring of glaucoma

Glaucoma can rapidly or insidiously damage the optic nerve and impair vision. Early detection through IOP monitoring is key to control glaucoma. Routine checks and annual screening for high-risk breeds improve early detection.

Standard equipment for general consultations

The inclusion of reliable tonometry devices as standard tools in companion animal practices to enable accurate diagnosis and treatment adjustment of ocular disorders.

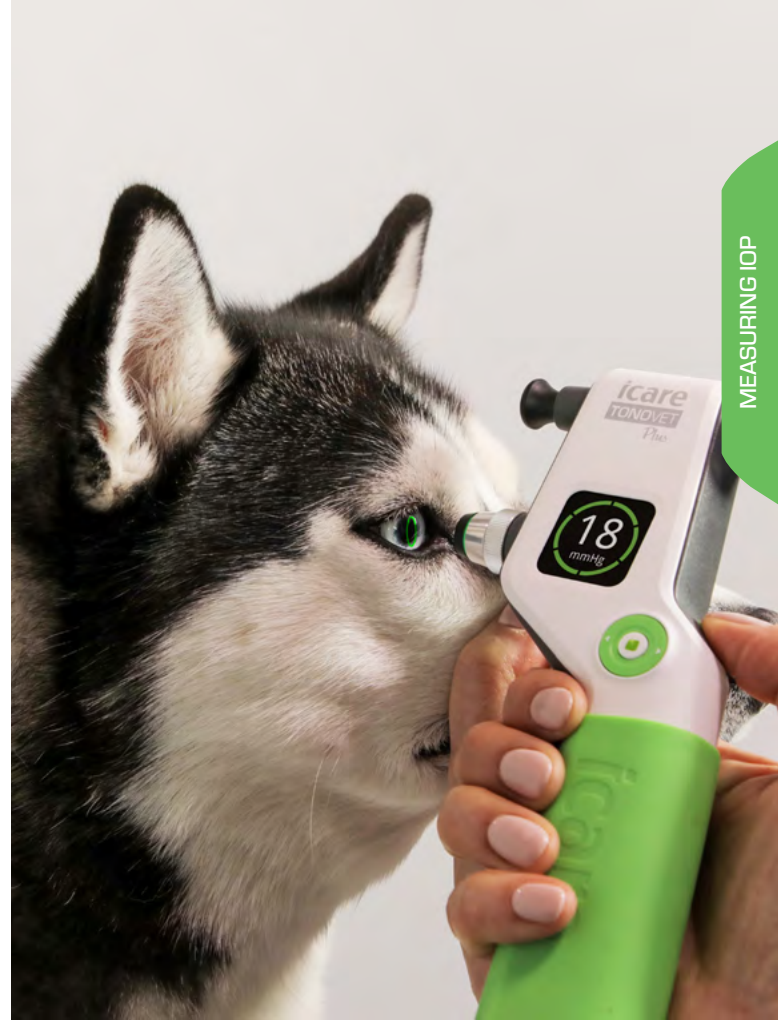
Clinical application scenarios of the TONOVET tonometer

In our teaching hospital, the TONOVET Plus is used to monitor IOP in general ophthalmic consultations, all “red eye” cases, postoperative follow-ups, and routine screening of high-risk glaucoma breeds. The goal is to quickly and accurately monitor IOP changes to support clinical decisions.

In our clinical and teaching setting, the TONOVET Plus, with its anesthesia-free, calibration-free operation, alignment assistance, and one-click measurement, has significantly enhanced IOP measurement efficiency and accuracy. It strengthens the management of red-eye, glaucoma, and postoperative cases. Overall, it is an excellent and must-have diagnostic tool to incorporate into routine ophthalmic exams and long-term follow-up protocols in clinical practice.

Important reminders

IOP reference ranges serve only as clinical guides and must be interpreted in conjunction with comprehensive ocular examination. Failure to measure IOP or improper technique may lead to misdiagnosis. Establishing standardized operating procedures of ophthalmic examinations can significantly improve diagnostic accuracy.



“

We have widely adopted the TONOVET Plus in veterinary student training, clinical diagnostics, and postoperative follow-ups. Its performance is consistent and accurate, making it a trustworthy diagnostic tool. We strongly recommend that all veterinary clinics or hospitals conducting ophthalmic examinations be equipped with this important device to enhance the quality of service and animal care.



Practical considerations for EQUINE TONOMOMETRY

Today's horse owner is interested in wellness. Veterinary medicine is now seeing the veterinarian providing regular examinations to identify and treat problems early. IOP measurements can be incorporated into annual wellness programs; providing this service can differentiate a practice or practitioner from others.



Early detection of ocular disease in horses

Glaucoma in horses is a common complication of chronic uveitis, particularly in Appaloosas, other spotted breeds, and Warmbloods. It is a blinding disease. Normal intraocular pressure would fall between 15-30 mmHg in each eye. Tonometry that checks for ocular hypertension (>30 mmHg) will identify horses at risk at an early stage where medication may delay vision compromise. Horses with acute uveitis usually show abnormally low IOP (<15 mmHg) in the affected eye(s). Breeds at risk for glaucoma, are particularly Appaloosas and other spotted breeds like Knabstrappers, Pony of the Americas, Nez Pierce, etc.

The **TONOVET Pro** and **Plus** tonometers feature a dedicated equine setting, offering a safe and stress-free way to monitor IOP in horses, with no device calibration required.

“ Most horses will display aversive head movement when they see a tonometer looming a few centimeters away from their eyes; due to their large size this head movement cannot be countered safely or effectively by the handler.

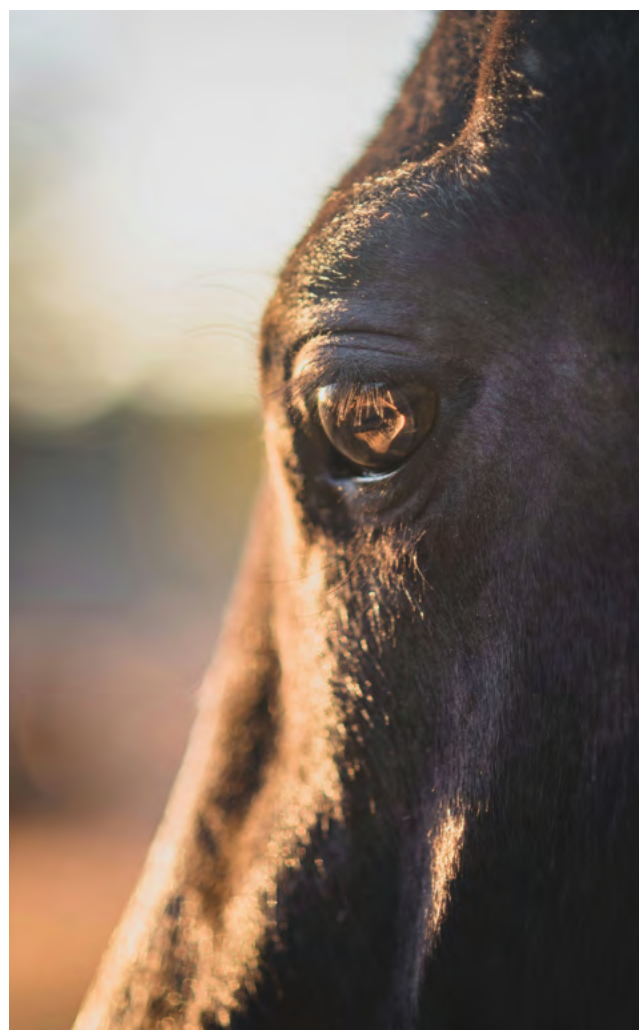
Due to a horse's size and height, it can be harder to obtain intraocular pressure no matter the tonometry method. They will not always allow a handler to place/hold their head in an optimum plane like a dog will. Most horses will display aversive head movement when they see the tonometer looming a few centimeters away from their eyes; due to their large size this head movement cannot be countered safely or effectively by the handler. The iCare TONOVET and TONOVET Plus do not require topical anesthesia, and there is no device calibration needed. The TONOVET Plus features a probe base positioning light system and audible sounds when taking measurements: both the light and the sound can be turned down or off in the case that the equine patient is bothered by them.

Instructions for measuring equine IOP

If the horse is comfortable, mature, well handled, and has a mild temperament, try to perform tonometry **without auriculopalpebral block or sedation**. If the horse exhibits resistance/blepharospasm when the examiner lifts the target eyelid, and/or reacts with aversive head movements when the tonometry is attempted, *light* intravenous sedation and auriculopalpebral blocks are needed. If the horse is fractious, young, untrained, painful, or exhibiting blepharospasm at rest, *deeper* intravenous sedation in addition to auriculopalpebral nerve blocks must be performed prior to ocular examination, diagnostic tests, or treatment.

STEP 1: Ensure optimal head positioning

- + The handler should ensure that the horse's head is at a “normal” stance with the head above the heart. Excessive physical restraint should be avoided.
- + When sedated, the horse's head can be supported on a “bale table” or other suitable rest for the mandible at a height where the head is above the heart. Ensure the head is not tipped.
- + The handler should always stand on the side opposite the eye being measured.



STEP 2: Prepare the eye for measuring

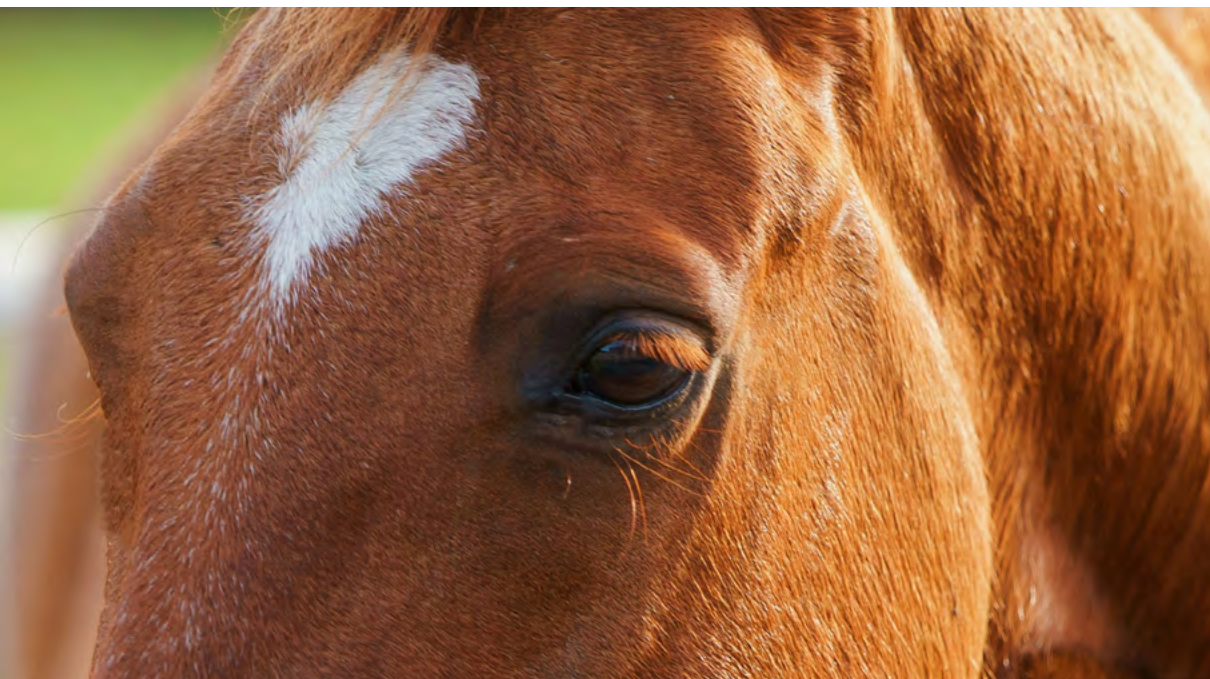
- + The examiner holds the TONOVET Plus in one hand and uses the index finger, or index finger and thumb, to elevate the eyelid.
- + Some horses will hold their lids open during tonometry without any manual intervention, but most will blink unless they have been “trained” to the procedure and attempting tonometry on the corneal surface may induce aversive head movement.

STEP 3: Take measurement

- + The examiner presses the measure button to induce corneal contact.
- + Some examiners will use the manual option that collects 6 measurements individually. Some will press and hold the button to collect 6 measurements in a row. Some horses are more amenable to one technique or the other.
- + The process is repeated in the other eye.

Key tips for success

- + **Insert a new probe for every patient.**
Do not attempt to clean or reuse probes. If both eyes are healthy (no evidence/suspicion of infection) the same probe can be used on both globes. If one or both eyes have surface pathology suggestive of infection, the probe should be changed between eyes.
- + **Ensure optimal distance from the cornea**
The tonometer probe head should be positioned approximately 4-8 mm away from the cornea. The “too near, too far” red arrow message (no reading) feature on the TONOVET Plus screen will teach the proper working distance.
- + **Pay attention to correct positioning**
During the measurement, the probe should be parallel to the floor and perpendicular to the cornea. This orientation can be achieved with the instrument handle in various positions. The red light/green lighting system on the TONOVET Plus will help you know the acceptable instrument orientation range.
- + **Measure along the axial center**
Measure the IOP close to the axial center of the cornea in healthy eyes. If the eye has focal pathology in that area, measure the IOP in a clear corneal region as close to the axis as possible.
- + **Avoid using excessive restraint**
Avoid the use of a nose twitch for patient restraint; this procedure can increase IOP. If the patient is not cooperative, use a combination of light sedation and an auriculopalpebral nerve block to obtain readings.
- + **Be gentle when exposing the cornea**
Most horses require some traction on the eyelid to expose the target region of the cornea. Excessive traction on the eyelids or inadvertent pressure on the globe should however be avoided. The auriculopalpebral block will counter blepharospasm of the lids. Some clinicians gently “pinch” the skin of the upper lid with the thumb and index finger of the hand that is not holding the tonometer to raise the lid above the central cornea. Others may raise the eyelid skin by pushing a section of skin near the orbital rim in an upward direction and resting the finger/skin section on the orbital rim.
- + **Consider which environments to measure in**
Environments with extremely high humidity have been reported to be associated with variable functionality of the rebound tonometer. Ambulatory use of the tonometer in various barns is associated with high exposure to dust and grime. This may also affect functionality.
- + **Clean the probe base regularly**
Cleaning the probe base more often than the 6 months recommended in the user manual will optimize the instrument’s function when exposed to excessive humidity or dirt and grime. Cleaning bimonthly or monthly, or after any excessive exposure of the instrument to humidity or grime, may be optimal in extremely hot, humid, or dirty environments.
- + **Handle with care**
The probe base should be completely dry before insertion back into the instrument. The probe base should be replaced with a brand new one every 12 months.





Introducing the TONOLAB

REBOUND TONOMETRY DESIGNED FOR RODENTS

J. Cameron Millar, PhD

*Senior Scientist III, Glaucoma Research
Alcon Research, Ltd*

Limitations of existing IOP measurement techniques for rodents

Previously, non-invasive intraocular pressure (IOP) data has been obtained in rats and mice using the Tono-Pen XL®, a hand-held device based on the strain gauge principle. However, it has proven difficult to acquire proficiency in measuring IOP in these animals using this method. Data acquisition is also highly operator-dependent, and the device underestimates IOP, particularly at higher IOP values. This is because the Tono-Pen XL® is designed for use in humans, in which the eye is much larger with different corneal mechanical properties. Topical anesthesia is also required prior to obtaining readings.

Some inroads have been made using the Goldmann applanation tonometer in rats and mice for non-invasive IOP measurements. But the instrument must be modified, and two people are required to take measurements. The use of topical anesthesia and fluorescein is required.

The TONOLAB, is based on a different principle from either the Tono-Pen XL® or the Goldmann tonometers. Unlike previous instruments of varying designs intended for use only in humans, the TONOLAB has been specifically designed for use in rats and mice.

The TONOLAB solution

TONOLAB operates on the rebound principle. A disposable lightweight probe, weighing between 11 and 13mg, and incorporating a smooth tip, strikes the eye at a speed of 10 to 20 cm/sec, propelled by a solenoid, with a force of only 50 to 300µN.

Most of the kinetic energy (about ¼ µJ) of the probe is rebounded from, rather than absorbed by, the eye, thus topical anesthesia is not required. Indeed, conscious animals show no sign of irritation or discomfort, even after repeated measurements. The small impact force also means that there are no issues with pseudo facility. Motion parameters during the collision (deceleration, impact time) are measured electronically and related to IOP via an internal algorithm. The instrument takes six individual readings and then displays the mean with an estimate of standard deviation (expressed as high, medium, low, or very low).

Using the TONOLAB, accurate and reproducible data (confirmed in operator-blind calibration studies) have been generated quickly and easily by multiple operators, all in conscious animals without the need for topical anesthesia or fluorescein. This instrument has become a choice for easy, non-invasive measurement of rodent IOP.



MEASURING THE EXTRAORDINARY

The unique IOP challenges of exotic and wildlife ophthalmology

*Kanokpich Imcharoon, Benchapol Lorsunyaluck
Panalai Veterinary Hospital, Thailand*

With the growing popularity of exotic pets, practicing ophthalmology in these unique and wildlife species feels like stepping into an entirely different world.

The availability of accurate diagnostic tools has become a cornerstone of effective ocular healthcare in these animals. Each species presents unique anatomical features, behavioral traits, and heightened sensitivity to stress. When stress occurs, it can affect animal pressure, making intraocular pressure (IOP) measurement in these species challenging.

Furthermore, many of these animals have species-specific IOP reference ranges that are not well established, adding another layer of complexity to diagnosis and treatment.

Restraint methods in IOP measurement

The restraint method is one of the most critical factors influencing IOP measurement. In research on peregrine falcons (*Falco peregrinus*), we compared IOP values obtained using the iCare® TONOVET Plus rebound tonometry with dog calibration settings during manual versus burrito restraint. This difference highlights the importance of minimizing stress and pressure during handling to avoid artificially elevated readings.

Calibration choice can influence results

Another challenge arises when measuring IOP in species not covered by the standard TONOVET calibration modes (canine, feline, leporine, equine). In our study on the Pacific parrotlet (*Forpus coelestis*), we evaluated the effects of different calibration settings on IOP values, with a statistically significant difference observed. These findings highlight that calibration choice can influence results and must be carefully considered when working with exotic avian species. It is critically important to know which device and calibration mode were used when referencing IOP values, as differences between devices and settings can significantly affect readings. Misinterpreting IOP due to unverified reference standards may lead to inaccurate diagnosis and inappropriate treatment.

Measuring IOP in small eyes presents additional challenges. Excessive handling or improper positioning can lead to stress-induced artifacts or even injury. TONOVET tonometers help address these concerns through the use of light-contact probes and rapid reading, without causing corneal damage even in very small eyes. These features offer essential flexibility for safely and effectively assessing uncooperative or fragile species such as psittacines.



Why IOP monitoring matters in avian patients

Although often underappreciated, measuring intraocular pressure (IOP) in birds plays a vital role in the diagnosis and management of ocular diseases. Like dogs and cats, avian species can suffer from conditions such as glaucoma and uveitis, both of which require prompt intervention to preserve vision and comfort. One illustrative case involved a cockatiel presented with noticeable buphthalmos. Tonometry revealed a significantly elevated IOP of 55 mmHg in the affected eye, while the contralateral eye remained within normal limits at 18 mmHg. With the initiation of topical anti-hypertensive medications and regular pressure monitoring, the bird showed marked clinical improvement.

In another case, a barn owl was evaluated for aqueous flare and anterior lens luxation. IOP measurement showed 22 mmHg in the right eye and a notably low 8 mmHg in the left. These findings, alongside other clinical signs, led to a diagnosis of anterior uveitis in the left eye. Following appropriate medical treatment and continued monitoring, the IOP returned to normal, confirming resolution of inflammation. These examples underscore the importance of IOP assessment in avian species not only for early detection but also for guiding treatment and monitoring disease progression. ■

Type	Mean $\pm$ SD	Min - Max
Manual	18.28 $\pm$ 1.74 mmHg	15–22 mmHg
Burrito	19.72 $\pm$ 2.02 mmHg	17–24 mmHg

Calibration mode	Mean $\pm$ SD	Min - Max
Dog	14.86 $\pm$ 0.58 mmHg	13–16 mmHg
Cat	8.67 $\pm$ 0.66 mmHg	8–10 mmHg
Rabbit	15.21 $\pm$ 0.67 mmHg	14–17 mmHg
Horse	10.98 $\pm$ 0.64 mmHg	10–12 mmHg

PROFITABLE TONOMETRY

Tonometry without pressure

What is tonometry?

Tonometry is a test to measure the pressure inside your animal's eyes. It is an essential diagnostic tool in the workup of animals with ocular conditions and all head trauma patients. iCare TONOVET tonometers are accurate, reliable and easy to use, while also profitable for veterinary professionals.

Why is it necessary?

The importance of diagnostic tonometry is well established. Glaucoma and ocular hypertension are significant threats to the vision of veterinary patients. As primary care providers, it is important that general practitioners are able to recognize and document increases in intraocular pressure to ensure appropriate treatment and preventative care.

What are the benefits for a vet clinic?

The iCare TONOVET rebound tonometers are quick, easy-to-use and patient-friendly, requiring no anesthesia or calibration. With TONOVET Plus anybody can take accurate readings as the device guides the user and the quality of the results is clearly indicated. Vets often comment how surprised they are of how much they've ended up using the TONOVET – because it's so quick and easy.

How to ensure return on investment?

Use your tonometer to establish baseline readings on all patients during their first presentation, or in the first few years of life. For those predisposed to glaucoma, monitor IOP annually or more often. It should be checked during all ophthalmological examinations, all head or eye trauma patients, and in all patients over 6–7 years of age. Always measure both eyes so their IOP can be compared and accurately interpreted in formulating a diagnosis.

Pay back analysis

ADD VALUE & CARE + INCREASE PROFIT

Number of exams / week	5				10				50			
Examination charge / test	10	20	30	40	10	20	30	40	10	20	30	40
Examination cost / test	3 (probe + time)											
Examination income / test	7	17	27	37	7	17	27	37	7	17	27	37
Number of examinations / year	260				520				2600			
Total income / year	1,820	4,420	7,020	9,620	3,640	8,840	14,040	19,240	18,200	44,200	70,200	96,200
Total investment	3,000											
Payback time / weeks	94.3	38.8	24.4	17.8	47.1	19.4	12.2	8.9	9.4	3.9	2.4	1.8

Example – prices vary per market



TONOVET IN PRACTICE

A VETERINARIAN'S USER EXPERIENCE FROM JAPAN

We asked **Dr. Kazunori Mikuni**, Director of the Mikuni Veterinary Hospital/Ophthalmology Clinic in Sapporo, Hokkaido, and **Dr. Kumiko Hata** about the TONOVET tonometer.

What interested you in TONOVET?

What first interested me was its unusual shape. It was not the shape I had imagined. When I tried using it, I realized the connection between its shape and the way it measures. With the tonometer I used to use, I sometimes dropped it if the animal moved while I was taking a measurement, because you only held it between your fingertips. Because you had to move your wrist or arm to take measurements, it was hard to keep the tonometer still, meaning that data readings could be unstable. The TONOVET is a little larger than ordinary tonometers, but it is easier to hold because the shape

allows you to grip it properly with your hand. I also believe that it will produce reliable data, because taking measurements by just pressing a button means that it is easy to keep the device still and the measurement site is stable. As it does not require anesthetic eye drops, I tried it on myself, and it did not hurt. I decided to start using it because the short time from preparation to completion of the measurement made it very convenient, which I thought would be kinder to the animals, so that I could use it even in cases which were previously difficult to measure.

What is it like to use the TONOVET?

It is easy to use for measuring animals with small eyes, such as Shiba Inu, because you can take a measurement even if the eyes do not open very wide. With the old type of tonometer, there was concern that pressure on the eyeball while the eyelid was open would raise intraocular pressure, because you needed to bring a large surface area into contact with the eye. With TONOVET you can be more confident about the measurement data, because this problem is solved.



“

Owners who have been coming to the clinic for a long time and thought the older kinds of IOP measurements were time-consuming and unpleasant now say everything is ‘nice and quick’ since I started using TONOVET.”

How do you feel now that you have started using TONOVET?

I am very glad I started using it. When I first started in ophthalmology, I used manual examination or a Schiøtz tonometer to measure intraocular pressure (IOP). I later used a hand-held applanation tonometer, and now use TONOVET, so I have used all sorts of devices. Owners who have been coming to the clinic for a long time and who thought that the older kinds of IOP measurements were time-consuming and unpleasant now say everything is ‘nice and quick’ since I started using TONOVET.

What do you think of the advantages of not needing anesthetic eye drops or calibration?

The shorter pre-measurement preparation time is a great advantage. Obviously, you do not have the trouble of administering eye drops, nor do you need to worry about causing discomfort with the anesthetic drops or about changes in lacrimal fluid levels. Nor is there any worry about long term side effects (such as dry eyes). You must be careful when using anesthetic eye drops on cats, so I think it is safer if you do not need eye drops at all. Using older tonometers was sometimes time-consuming and frustrating because you had to keep recalibrating.

When this kind of thing continues, you tend to become wary of using IOP measurement at all, but TONOVET takes away the stress of the measurement, because it does not require calibration. I have therefore become much keener on taking IOP measurements – I have been negative about them in the past. As a result, I now take twice as many measurements. Animal hospitals require all kinds of tests, depending on each case, and it is important to be able to get over these (tests) smoothly and quickly. I think TONOVET is the only tonometer that meets that requirement, as it allows simple and easy IOP measurements

How do you rate the measurement data of TONOVET?

My impression is that the instrument always produces stable, highly reproducible data. The old tonometers had a large, flat contact panel, and the measurement was taken by pressing this against the cornea, so the data were affected by differences in things such as the position of the person taking the measurement and how they pressed the instrument against the eye, or the curvature of the cornea. On the other hand, with TONOVET, I think there are fewer mistakes in the size of the eyeball, the curvature of the cornea or the angle of contact, because the probe is smaller and the measurement is taken by bringing this into contact with the cornea at a single point.

How do the animals behave during the measurement, compared to before?

Taking IOP measurements with animals that were previously difficult to measure has become easier. I think TONOVET keeps the animal's stress to a minimum, because there is no need for anesthetic eye drops, so the measurement is quicker. It is very important not to cause stress, because if an animal has a bad experience, it will become difficult to examine and treat it the next time. I am also less stressed, because fewer animals are impossible to measure, and the preparation/measurement time is shorter.

You have been involved in veterinary ophthalmology for many years – how do you make people aware of ophthalmic care?

When I give an animal an all-over check, I ask the owner questions like, 'Do the animal's eyes get red? Do they get itchy or blurry?' In cases of this kind, or with owners of breeds which are prone to suffering from glaucoma (Shiba Inus, Cocker or Cavalier Spaniels, Shih Tzus, Pugs, or Maltese terriers), when I perform a check-up along with their anti-rabies injection or vaccinations, I explain the importance of IOP tests and ask if they would like me to check the animal's eyes as well. If the test results are in the grey zone, I have them come to the clinic about every three months and track their progress.

An owner once told me, 'yesterday, my animal suddenly seemed to go blind and has since been walking around bumping into things.' When I examined the animal, my observations suggested that it had probably lost sight in one eye the day before, but it had not been able to see with the other eye for some time. It is rare for both eyes to develop high IOP at the same time. If the problem had been noticed, we might have been able to preserve the sight in the good eye for longer.

In some cases, we can prevent blindness occurring if an early diagnosis is made, but it is a great shame that, with animals, it is often too late. Taking IOP measurements every time an animal has its inoculations is very helpful for the early diagnosis of glaucoma.

Are there any particular illnesses or symptoms in which you would measure IOP?

If the eyeball is protruding, we measure IOP to determine whether it is due to glaucoma or an orbital lesion, and if the size of the pupil causes concern, we also take a measurement to determine whether it is due to a neurological illness. In many cases the IOP measurement shows that it is actually uveitis. When we prescribe eye drops for glaucoma, it is important to measure IOP to check that the eye drops



are working. After cataract operations, we measure IOP to determine the extent of inflammation in the eye or the condition of the sutures. In this case, the eyelids cannot open much, because they are sewn up to protect the suture on the eyeball. Similarly, it is very painful for the patient if its eyeball is damaged due to corneal erosion or corneal ulcers which make it difficult to open the eyelids and hold the animal still. Because TONOVET only needs to come in contact with a small area on the cornea, it's possible to measure IOP even in cases where the eyelids cannot open properly.

What kind of treatment do you use if you diagnose glaucoma early?

It depends on the situation, but we usually lower the IOP with eye drops, drips, or oral medication. If there is no improvement using eye drops, or if the animal will not take oral medication, we either carry out a cyclophotocoagulation operation using a laser diode or insert a glaucoma valve. ■



CARING FOR YOUR TONOVET

Using a probe base cover helps protect your TONOVET by preventing dust and dirt from entering the base. All new units come with a green silicone grip, and both the probe base cover and silicone grips are available as accessories.

Can probes be reused?

iCare TONOVET tonometers operate on a rebound principle, where a lightweight probe moves within a magnetic field. The probe consists of a gold-plated metallic wire that allows proper movement and a small tip made of medical-grade plastic that gently touches the cornea. The probe's weight and straightness tolerances are precisely controlled to ensure accurate intraocular pressure (IOP) measurements.

To ensure safe and reliable measurements, the probe is designed for single use only. Probes should never be cleaned or sterilized, as these processes can damage the probe and result in unreliable measurements or even harm to the tonometer. However, the same probe can be used for measuring the same patient within a short period.

- ✗ CROSS-CONTAMINATION**
 Re-use of the probes can cause cross-contamination of bacteria, viruses and particles.
- ✗ OPERATIONAL UNRELIABILITY**
 Re-using the probe allows dirt, grease, debris and other particles to attach to the metallic wire and the plastic tip resulting in possible damaging of the probe or the device.
- ✗ INCORRECT MEASUREMENT VALUES**
 Accuracy of the device is not guaranteed if the probe is reused, and this may result in incorrect measurement values.

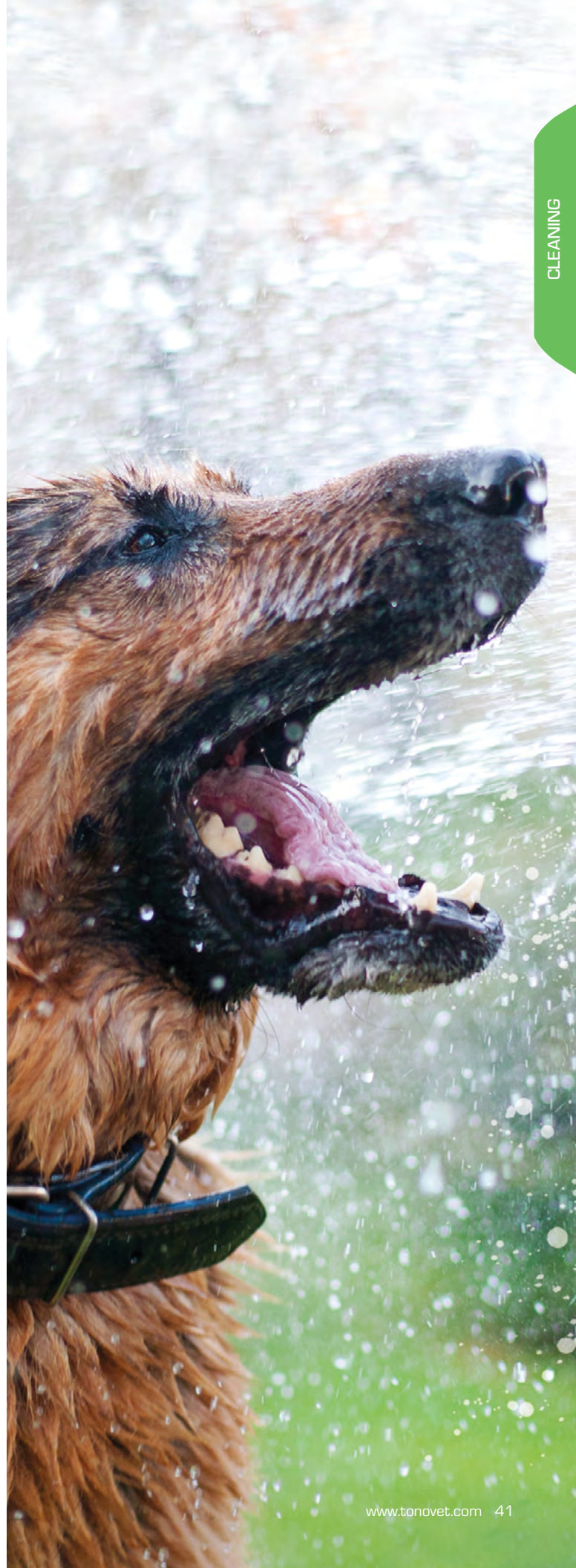
Cleaning the probe base

Clean the probe base whenever you notice the device slowing down or producing more errors, or at least every three to six months. If the issues persist even after cleaning, or after 12 months of use, consider replacing the probe base. All TONOVET tonometers (except TONOVET Pet) include two probe bases: one installed in the unit and one stored in the case.

Instructions for cleaning:

- 1 Fill the container**
Fill a spare probe base container or another small clean container with 70-100% isopropyl alcohol.
- 2 Turn off the device**
Ensure the tonometer is powered off.
- 3 Remove the probe base collar**
Unscrew the probe base collar gently to avoid stripping the threading.
- 4 Remove the probe base**
Tilt the tonometer downwards and pull the probe base out.
- 5 Soak the probe base**
Insert the probe base into the cleaning container and let it soak for 5-30 minutes.
- 6 Dry the probe base**
Remove the probe base from the cleaning container. To dry it, use a hairdryer to thoroughly dry the probe base, blowing the air into the narrow end of the probe base. After drying, it is best to let the probe base sit out overnight to ensure it is completely dry before placing it back into the unit.
- 7 Reinstall the probe base**
Insert the probe base back into the tonometer.
- 8 Secure the probe base**
Screw the probe base collar back on gently, just until snug. Do not overtighten the collar to avoid damage to the threading.

Note: It is very important to let the probe base dry completely before placing it back into the unit. Utilizing the spare probe base that comes with your unit allows you to continue working while the other probe base dries after cleaning. It is always good to have at least two probe bases on hand.



CLINICAL STUDIES

Validation of Recalibrated TONOVET Plus and TONOVET Pro in Canine Eyes Compared to Manometer and TONOVET

Published: Veterinary Ophthalmology 2024

Authors: Jiwon Lee, Wontae Kim, Jaeho Shim, Yujin Kim, Seonmi Kang, Young- Kyoung Yoo, Young-Ho Lee, Kangmoon Seo

OBJECTIVE

To evaluate the accuracy of recalibrated TONOVET Plus (rTVP) and the newly released TONOVET Pro (TVPR) in measuring intraocular pressure (IOP) in ex vivo canine eyes compared to manometer and the established TONOVET (TV).

PROCEDURE

Sixteen enucleated canine eyes were cannulated to establish manometric IOPs ranging from 5 to 80mmHg. IOP measurements were obtained using TV, rTVP, and TVPR.

RESULTS

All tonometers showed a strong correlation with the manometer ($R^2 > 0.98$). Measurements from rTVP and TVPR exhibited almost perfect agreement with the manometer ($CCC = 0.9974$ for both), whereas TV demonstrated lower agreement ($CCC = 0.9874$) associated with greater systematic bias. Specifically, TV showed a

lower proportional bias (95% confidence interval [CI] of the slope = 0.987–1.006) but a larger systematic bias (intercept = –3.33mmHg) compared to rTVP and TVPR (95% CI of the slope = 1.045–1.066 and 1.045–1.063; intercept = –2.532 and –2.633mmHg, respectively). In accuracy analyses by range, rTVP and TVPR showed no significant difference from the manometer in the 30–70mmHg and 35–80mmHg IOP ranges, respectively.

CONCLUSIONS

Among the iCare rebound tonometers, rTVP and TVPR provided the most accurate IOP measurements in the ex vivo analysis and demonstrated particularly strong agreement in the high IOP range, suggesting their suitability for IOP measurement in glaucomatous patients.

Owner Obtained Intraocular Pressure Measurements in Canine Primary Angle Closure Glaucoma: A Pilot Study in 14 Dogs

Published: Veterinary Ophthalmology 2026

Authors: Hans D. Westermeyer, Jacklyn H. Salmon

OBJECTIVE

To explore the clinical value of intraocular pressure (IOP) measurements obtained by owners in dogs predisposed to primary angle closure glaucoma (PACG).

PROCEDURE

Owners of 14 dogs with eyes predisposed to developing PACG obtained IOP measurements with a TONOVET Plus from the time of diagnosis of PACG until they developed clinical PACG or were lost to follow up.

RESULTS

Owners measured IOP values in 14 dogs. In nine dogs, IOP was measured until they developed overt glaucoma with marked IOP elevations. Four dogs were lost to follow-up, and IOP continues to be monitored in one dog. In seven of the nine dogs that developed overt glaucoma, onset of glaucoma was associated with a sudden rise in IOP > 50 mmHg that was not preceded by an obvious gradual rise in average IOP readings or prior smaller rises in IOP. Dogs that were treated with latanoprost following the onset of overt glaucoma continued to have sporadic rises in IOP.

CONCLUSIONS

Owner obtained, at home IOP measurements can provide information that may be useful in the management of canine PACG.

Comparison of two rebound tonometers in healthy horses

Published: Veterinary Ophthalmology 2020

Authors: Minna P Mustikka, Elina M Pietilä, Anna K Mykkänen, Thomas S C Grönthal

OBJECTIVE

To obtain a reference range for evaluation of intraocular pressure (IOP) in horses using TONOVET Plus, to compare the IOP readings obtained with TONOVET and TONOVET Plus, and to evaluate the repeatability of readings.

PROCEDURE

Intraocular pressure of 30 client-owned horses (60 eyes) with no signs of illness or ocular disease was evaluated using TONOVET and TONOVET Plus rebound tonometers. Horses' mean age was 10.7 (range 6-17) years. Triplicate measurements were performed without using sedatives or local anesthetics, with minimal restraint.

RESULTS

Calculated reference intervals (the CLSI robust method) were 14.4-27.2 mmHg for TONOVET and 16.0-26.1 mmHg for TONOVET Plus. Mean values ($\pm$ standard deviation, SD [$\pm$ coefficient of variation, CV]) obtained with TONOVET Plus (21.6 ± 2.45 mmHg [11.3%]) were on average 0.6 mmHg higher than with TONOVET (21.0 ± 3.14 mmHg [15.0%]), and a negligible statistical difference between the devices was found using the paired sample t test ($P = .049$). The correlation coefficient for the averaged triplicate measurements was 0.73. The average CV was 4.6% and 4.4% for TONOVET and TONOVET Plus, respectively.

CONCLUSIONS

The repeatability of measurements was very good with both devices. The readings between the two devices differed statistically significantly, but the correlation was considered good and the variation was numerically small, and thus, the difference was considered clinically irrelevant. When monitoring disease process or treatment response in an individual patient, repeated readings are best performed using a similar device to avoid false interpretation of results.

Validation of the iCare® TONOVET Plus rebound tonometer in normal rabbit eyes

Published: Experimental Eye Research 2019

Authors: Shawna Gloe, Abby Rothering, Julie A Kiland, Gillian J McLellan

OBJECTIVE

To determine the accuracy and precision of the iCare® TONOVET Plus rebound tonometer for measuring intraocular pressure (IOP) in normal rabbit eyes, as well as compare it to three other commercially available tonometers: the iCare® TONOVET (TV01), Tono-Pen Vet™, and Tono-Pen AVIA Vet™.

PROCEDURE

The anterior chambers of both eyes of three New Zealand White rabbits were cannulated, post-mortem. IOP was measured using each of the above four tonometers at manometric pressures ranging between 5 mmHg and 70 mmHg. Data were analyzed by linear regression, ANOVA, and Bland-Altman plots. A p-value of ≤ 0.05 was considered significant for all statistical tests.

RESULTS

IOP values obtained with the TONOVET Plus (in 'lapine' mode) were significantly closer to manometric IOP than those obtained with the other tonometers tested. The TV01 (in 'd' dog setting) and Tono-Pen AVIA Vet™ were significantly more accurate compared to the Tono-Pen Vet™. All tonometers had high levels of precision, though the TONOVET Plus and TV01 were significantly more precise compared to the Tono-Pen AVIA Vet™. All tonometers tended to underestimate IOP, particularly at high pressures, however the TONOVET Plus was highly correlated with manometric IOP in the clinically relevant range of 5 – 50 mmHg. The TONOVET Plus is an appropriate choice of instrument for measuring IOP in rabbit eyes in both research and clinical settings.

CONCLUSIONS

In conclusion, the iCare® TONOVET Plus rebound tonometer provides IOP readings in normal rabbit eyes which are highly precise, and are significantly more accurate than readings obtained with the TONOVET, Tono-Pen Vet™, and Tono-Pen AVIA™. Based on the above findings, the iCare® TONOVET Plus appears to be the most appropriate choice currently available for measuring IOP in rabbits in a clinical or research setting.

Validation of the TONOVET rebound tonometer in normal and glaucomatous cats

Published: Veterinary Ophthalmology 2013

Authors: McLellan GJ, Kemmerling JP & Kiland JA

OBJECTIVE

To validate intraocular pressure (IOP) readings obtained in cats with the TONOVET tonometer. IOP readings obtained with the TONOVET were compared to IOP readings determined by manometry and by the Tono-Pen XL in 1 normal cat and two glaucomatous cats. TONOVET and Tono-Pen XL readings were also compared in a further six normal and nine glaucomatous cats.

PROCEDURE

The anterior chambers of both eyes of three anesthetized cats were cannulated and IOP was varied manometrically, first increasing from 5 to 70 mmHg in 5 mmHg increments, then decreasing from 70 to 10 mmHg in 10 mmHg decrements. At each point, two observers obtained three readings each from both eyes, with both the TONOVET and Tono-Pen XL. IOP was measured weekly for 8 weeks with both tonometers in six normal and nine glaucomatous unседated cats. Data were analyzed by linear regression. Comparisons between tonometers and observers were made by paired student t-test.

RESULTS

The TONOVET was significantly more accurate than the Tono-Pen XL ($P=0.001$), correlating much more strongly with manometric IOP. In the clinical setting, the Tono-Pen XL underestimated IOP when compared with the TONOVET.

CONCLUSIONS

Both the TONOVET and Tono-Pen XL provide reproducible IOP measurements in cats; however, the TONOVET provides readings much closer to the true IOP than the Tono-Pen XL. The TONOVET is superior in accuracy to the Tono-Pen XL for the detection of ocular hypertension and/or glaucoma in cats in a clinical setting.

To Applanate or to Rebound? A preliminary comparison of the Tonopen and TONOVET tonometers

Published: 2013

Authors: Williams D, Green M

ABSTRACT

For many years the Tonopen has been the standard, hand-held tonometer for veterinary use, providing an electronic measurement of intraocular pressure widely accepted throughout veterinary ophthalmology. It has some shortcomings, particularly when used in small eyes such as those of laboratory rodents, where the footplate is just too wide for accurate tonometry. More than 60 years ago, Obbink invented a totally different concept in tonometry, where a small probe is fired at the corneal surface and its rebound velocity is measured, this correlating with intraocular pressure. Dekking improved the technique thirty years later but it was not brought into widespread use until the beginning of this decade when Kontiola and colleagues developed a system for use in mice. The device has been marketed for the veterinary market as TONOVET. Comparison of this rebound or dynamic tonometer with the Tonopen applanation tonometer has been reported in the literature but only to date investigating animals with normotensive eyes. We have undertaken both in vitro and in vivo studies of the device but here we provide some preliminary in vivo evidence comparing the two tonometers in both normotensive and glaucomatous canine eyes.

METHOD

50 dogs of varying breeds with and without ocular pathology were included in the preliminary study. Dogs were examined ophthalmologically with direct and indirect ophthalmoscopy and slit lamp biomicroscopy. Measurements of intraocular pressure were performed with both tonometers. Topical anaesthetic (Amethocaine Minims, Chauvin) was applied to each eye 30 seconds prior to measurement with the Tonopen tonometer. Order of use of the TONOVET rebound tonometer and the Tonopen applanation tonometer was assigned randomly.

RESULTS

Four measurements were taken with each tonometer and the mean value was used as the intraocular pressure measurement for that eye. This mean value for intraocular pressure as measured with the TONOVET was plotted against the averaged readings for the Tonopen for each eye. In 12 dogs the mean value for one or other tonometer has a standard deviation greater than 10%, normally associated with a less than placid temperament. There was good correlation between the readings obtained with the TONOVET rebound tonometer and the Tonopen applanation tonometer ($r=0.96$), the TONOVET apparently over-estimated the intraocular pressure in severely glaucomatous eyes by around 2mmHg at 30mmHg, 5mmHg at 50mmHg and 7mmHg at 70mmHg.

CONCLUSIONS

Both tonometers were easy to use; the TONOVET had the advantage of not requiring local anaesthetic but the disadvantage of requiring horizontal use while the Tonopen can be used in any position. The good correlation between the two tonometers is encouraging although, as can be seen from figure 2 for each individual set of readings there can be significant variation between mean values. The higher values for the TONOVET compared with the Tonopen, especially in glaucomatous eyes is to be noted, although it is, of course, impossible from these readings to say which tonometer is providing the more accurate readings compared with the true pressure within the eye. We have performed experiments comparing TONOVET and Tonopen pressure readings in post-mortem eyes with the true intraocular pressure as determined by a U-tube manometer and will present these at a future meeting. This study shows that the TONOVET tonometer is a valuable tool in veterinary ophthalmology, useful for measuring the intraocular pressure in the canine eye.

Clinical comparison of the TONOVET

Published: Veterinary Ophthalmology 2013

Authors: Lena von Spiessen, Julia Karck, Karl Rohn and Andrea Meyer-Lindenberg

OBJECTIVE

To compare the TONOVET rebound tonometer with the Tono-Pen Vet applanation tonometer in a larger number of glaucomatous eyes and to evaluate the effect of different corneal pathologies on both tonometers.

PROCEDURE

In 26 eyes with clinical signs of glaucoma, intraocular pressure (IOP) was measured using the TONOVET followed by the Tono-Pen Vet. In 29 eyes with focal corneal pathology (e.g., corneal scarring, edema, pigmentation), both tonometers were used successively to measure IOP in one unaffected area of the cornea, as well as on the lesion itself. Impact on measurement results was assessed comparing the deviation in IOP readings of each tonometer between the two localizations. Statistical data analysis included paired t-tests and regression analysis using SAS software (version 9.2; SAS Institute, Cary, NC).

RESULTS

In glaucomatous eyes, the TONOVET consistently yielded higher values of IOP than the Tono-Pen Vet as can be quantified by the regression equation $IOP \text{ (TONOVET) [mmHg]} = 1.12 * IOP \text{ (Tono-Pen Vet) [mmHg]} + 11.5$ with $R^2 = 0.91$ and $P < 0.0001$. Depending on the type and degree of corneal pathology, the deviation in IOP resulting from measurements on altered cornea ranged from 6 to 16 mmHg for the TONOVET and 7 to 20 mmHg for the Tono-Pen Vet, respectively. On average, the effect of corneal disease on IOP measurements was lower for the TONOVET by 1.14 mmHg.

CONCLUSIONS

Rebound tonometry appears to be a valuable alternative to established applanation tonometry in patients with ocular disease such as glaucoma and corneal disorders. In patients suffering from glaucoma, the same type of tonometer should be used for follow-up examinations, as measurement results of the TONOVET and the Tono-Pen Vet differ substantially with increasing IOP. Corneal pathology has considerable influence on both tonometers with the degree of over- or underestimation of IOP depending on the alteration of biomechanical properties of the cornea inflicted by various corneal pathologies.

Evaluation of rebound tonometry in non-human primates

Published: 2011

Authors: Elizabeth J. Elsmo, Julie A. Kiland, Paul L. Kaufman, Gillian J. McLellan

OBJECTIVE

To determine the accuracy and reproducibility of intraocular pressure (IOP) measurements obtained with the TONOVET rebound tonometer in cynomolgus macaques and to determine the effects of corneal thickness on measurements obtained by the TONOVET.

PROCEDURE

The anterior chambers of both eyes of anesthetized monkeys were cannulated with branched 23-G needles; one branch was connected to a vertically adjustable reservoir and the other to a pressure transducer. IOP was increased by 5 mmHg increments and then decreased by 10 mmHg decrements. IOP was measured using the TONOVET at each increment and decrement by 2 independent observers and at every other increment and every decrement by a single observer using 'minified' Goldmann applanation tonometry. Central corneal thickness was measured with a PachPenTM ultrasonic pachymeter.

RESULTS

TONOVET readings correlated well with manometric IOP (slope $\frac{1}{4}$ 0.972, r^2 coefficient $\frac{1}{4}$ 0.955). No significant differences were observed when comparing eyes or operators; however there was a non-significant trend for TONOVET readings taken in right eyes to be closer to manometric IOP than those taken in left eyes. The TONOVET had a nonsignificant tendency to underestimate manometric IOP. TONOVET readings obtained during the decremental phase of the experiment were significantly closer ($p < 0.004$) to manometric IOP than those obtained during the incremental phase. Central corneal thickness significantly increased ($p < 0.0001$) over the course of the experiment.

CONCLUSIONS

The TONOVET rebound tonometer is a reliable and accurate tool for the measurement of IOP in cynomolgus macaques. This tonometer has several advantages, including portability, ease of use, and brief contact with the corneal surface making topical anesthetics unnecessary.

Reference intervals for intraocular pressure measured by rebound tonometry in ten raptor species and factors affecting the intraocular pressure

Published: *J Avian Med Surg.* 2011

Authors: Reuter A, Müller K, Arndt G, Eule JC.

ABSTRACT

Intraocular pressure (IOP) was measured with the TONOVET rebound tonometer in 10 raptor species, and possible factors affecting IOP were investigated.

METHOD

A complete ophthalmic examination was performed, and IOP was assessed in 2 positions, upright and dorsal recumbency, in 237 birds belonging to the families Accipitridae, Falconidae, Strigidae, and Tytonidae. Mean IOP values of healthy eyes were calculated for each species, and differences between families, species, age, sex, left and right eye, as well as the 2 body positions were evaluated. Physiologic fluctuations of IOP were assessed by measuring IOP serially for 5 days at the same time of day in 15 birds of 3 species.

RESULTS

Results showed IOP values varied by family and species, with the following mean IOP values (mm Hg +/- SD) determined: white-tailed sea eagle (*Haliaeetus albicilla*), 26.9 +/- 5.8; red kite (*Milvus milvus*), 13.0 +/- 5.5; northern goshawk (*Accipiter gentilis*), 18.3 +/- 3.8; Eurasian sparrowhawk (*Accipiter nisus*), 15.5 +/- 2.5; common buzzard

(*Buteo buteo*), 26.9 +/- 7.0; common kestrel (*Falco tinnunculus*), 9.8 +/- 2.5; peregrine falcon, (*Falco peregrinus*), 12.7 +/- 5.8; tawny owl (*Strix aluco*), 9.4 +/- 4.1; long-eared owl (*Asio otus*), 7.8 +/- 3.2; and barn owl (*Tyto alba*), 10.8 +/- 3.8. No significant differences were found between sexes or between left and right eyes. In goshawks, common buzzards, and common kestrels, mean IOP was significantly lower in juvenile birds than it was in adult birds. Mean IOP differed significantly by body position in tawny owls ($P = .01$) and common buzzards ($P = .04$). By measuring IOP over several days, mean physiologic variations of +/- 2 mm Hg were detected.

CONCLUSIONS

Differences in IOP between species and age groups should be considered when interpreting tonometric results. Physiologic fluctuations of IOP may occur and should not be misinterpreted. These results show that rebound tonometry is a useful diagnostic tool in measuring IOP in birds of prey because it provides rapid results and is well tolerated by birds.

Feline glaucoma – a comprehensive review

Published: *Veterinary Ophthalmology* 2011

Authors: Gillian J. McLellan and Paul E. Miller, USA

ABSTRACT

Cats with glaucoma typically present late in the course of disease. It is likely that glaucoma in cats is under-diagnosed due to its insidious onset and gradual progression, as well as limitations of some commonly used tonometers in this species. Treatment of glaucoma in feline patients presents a clinical challenge, particularly as glaucoma is often sec-

ondary to other disease processes in cats. In this review, we consider the clinical features, pathophysiology, and classification of the feline glaucomas and provide current evidence to direct selection of appropriate treatment strategies for feline glaucoma patients.

IOP in captive black-footed penguins (*Spheniscus demevsus*) measured by rebound tonometry

Published: J Avian Med Surg. 2010

Authors: Mercado JA, Wirtu G, Beaufrère H, Lydick D.

ABSTRACT

Intraocular pressure (IOP) measurement is a common procedure during eye examinations in birds. Differences in the IOP between avian species have been reported, which suggests the need to establish species-specific reference ranges.

METHOD

To determine IOP values of captive black-footed penguins (*Spheniscus demersus*), we obtained IOP readings with the use of a rebound tonometer by using two established calibration settings (dog and horse).

RESULTS

No difference was seen in the IOP between the left and right eye when the horse setting was used; however, a difference was present when using the dog setting. No significant difference between the IOP of male and female penguins was seen in both eyes when the dog or horse setting was used.

CONCLUSIONS

Rebound tonometry appears to be a safe and repeatable method to obtain IOP values in black-footed penguins.

Use of Rebound Tonometry as a Diagnostic Tool to Diagnose Glaucoma in the Captive California Sea Lion

Published: 2009

Authors: Johanna C. Mejia et al.

OBJECTIVE

One of the most common medical problems seen in the California sea lion (*Zalophus californianus*) is ocular disease. Glaucoma is a disease that has not been evaluated extensively in the sea lion. Observing clinical signs and measuring intraocular pressures (IOP) is critical for early diagnosis. The objective of this project is to measure IOP in clinically normal captive sea lions without ocular pathology to establish a normal range.

METHOD

The TONOVET was selected to be used in the study. The TONOVET uses a new non-invasive, rebound method to estimate IOP. An electrical magnetic tonometer probe comes into contact with and rebounds from the corneal surface to estimate an IOP. In order to record an accurate IOP, six measurements were taken and averaged resulting with the mean value. A complete ophthalmic examination has been performed on all sea lions by a veterinary ophthalmologist.

RESULTS

Currently, there are twenty sea lions in the study with no clinical ocular pathology. Overall mean in 39 healthy eyes was 32.8 mmHg with a SD +/- 3.2 at a 95% CI of 26.4 to 39.1.

CONCLUSIONS

We have established a normal baseline range for IOP values in captive sea lions without ocular pathology. This range is higher than the generally accepted range using other tonometers (e.g., Tono-Pen Vet®). This is likely due to the increased thickness of the pinniped cornea as well as the different mechanism of the instrument itself. This range will provide a comparative measurement when evaluating a diseased eye. By measuring the IOP regularly in juvenile sea lions, veterinarians will be able to determine when IOP's begin to change so that medical management can be started prior to loss of vision.

Comparison of the use of new handheld tonometers and established applanation tonometers in dogs

Published: Am J Veterinary Research 2006

Authors: Christiane Görig, Roel T. I. Coenen, Frans C. Stades, Sylvia C. Djajadiningrat-Laanen, Michael H. Boevé

OBJECTIVE

To examine the practical aspects, accuracy, and reproducibility of 2 new automatic handheld tonometers in dogs and compare them with results for 2 established applanation tonometers. Animals—15 freshly enucleated canine eyes for manometric evaluation and 20 conscious research dogs, 20 client-owned dogs, and 12 dogs with acute glaucoma for clinical tonometry.

PROCEDURE

Calibration curves were determined for all 4 tonometers on 15 enucleated canine eyes. Intraocular pressure (IOP) was measured with each tonometer consecutively in conscious dogs, with the MacKay-Marg applanation tonometer as the reference device. Measurements were repeated in 20 sedated dogs. An induction-impact tonometer was evaluated clinically on dogs with acute glaucoma. Additionally, measurements obtained by an experienced and an inexperienced examiner and with or without use of topical anesthesia were compared.

RESULTS

The portable pneumatonometer was cumbersome and time-consuming. Compared with results for the reference applanation tonometer, and confirmed by manometry, the portable pneumatonometer increasingly underestimated actual IOP values with increasing IOP. The induction-impact tonometer (=TONOVET) provided accurate and reproducible measurement values. There was a significant strong correlation between the IOP values obtained by the 2 examiners (r^2 , 0.82) and also with or without topical anesthesia (r^2 , 0.86). In dogs with glaucoma, the fitted line comparing values for the reference applanation tonometer and induction-impact tonometer closely resembled an ideal 1:1 relationship.

CONCLUSIONS

Use of the portable pneumatonometer in dogs appears to have disadvantages. The induction-impact tonometer (=TONOVET) appears to provide a promising alternative to the use of applanation tonometers in dogs.

FREQUENTLY ASKED QUESTIONS

Is the TONOVET measurement painless?

The measurement is painless. A light-weight probe touches the cornea momentarily. Most patients do not even notice the measurement.

Is the TONOVET measurement result accurate?

Numerous independent studies have verified the accuracy of TONOVET readings. Extensive bench testing and clinical trials have also been conducted to confirm both the accuracy and repeatability of the measurements. It is important to note that improper handling can significantly raise intraocular pressure (IOP). Therefore, proper measurement technique is essential.

Do all TONOVET tonometers use the same probes?

All TONOVET tonometers use the same standard probes, except the Tonolab, which requires specially designed probes.

Can TONOVET probes be reused?

To ensure safe and reliable measurements, the probe is designed for single use only. Probes should never be cleaned or sterilized, as these processes can damage the probe and result in unreliable measurements or even harm to the tonometer. However, the same probe can be used for measuring the same patient within a short period.

Can handling the patient affect the IOP?

Yes, it can significantly increase the IOP. Excessive restraining of the patient should be avoided, and if the eye needs to be held open, be careful not to add any pressure to the eyeball. If a collar is worn, make sure it is not too tight or remove the collar for the measurement. Pressure around the neck (jugular veins compressed) increases IOP. Measuring should always be done so that the patient is looking straight ahead in a natural, relaxed position. Even if the head is tilted sideways for measuring, it can affect the IOP and cause it to increase.

Why six measurements?

To obtain accurate measurement results using the TONOVET Plus, six measurements must be taken in a single sequence. The TONOVET Plus software automatically discards the highest and lowest readings, and the final result is the average of the four remaining measurements. Similarly to TONOVET Plus, the TONOVET Pro can also take six sequential measurements, and additionally features a quick measure option, calculating an intraocular pressure (IOP) measurement based on the average of only 2 to 3 sequential readings. Please note that when using the quick measure setting, the alignment assistance feature on the TONOVET Pro is automatically disabled.

Should both eyes be measured?

When possible, both eyes should always be measured for adequate information comparison.

What are the normal IOP ranges for using TONOVET?

'Normal' range is intended to serve as a **general guideline only** and should always be interpreted in the context of other visual findings. There is no sharp cut-off value between a healthy and a diseased eye. Tonometry should be performed in both eyes. The values of IOP should be within 5 mmHg between healthy eyes of the same subject.

What are the causes of increased IOP values to a healthy-looking eye?

Excessive restraint or the patient looking to the side can compress the jugular vein(s). A collar that is too tight can lead to abnormally high IOP values. Additionally, applying too much pressure around the eye, such as manually holding the eyelids open, can also contribute to increased IOP, as well as the patient's stress levels. Early-stage glaucoma, which may not present any ocular symptoms, can be detected through abnormally high IOP readings. Generally, IOP decreases with age. In dogs, diurnal variation causes changes in IOP, with levels peaking in the morning and gradually declining throughout the day. Conversely, it has been suggested that the opposite pattern may occur in cats and rabbits.

Can topical anesthesia still be used?

The iCare TONOVET rebound tonometer is designed for use without the need for a topical anesthetic. The light-weight probe touches the eye so gently that most patients hardly blink in response. For the most accurate measurements, we recommend avoiding the application of a topical anesthetic. While it is possible to measure an anesthetized eye, the readings may be slightly influenced by the swelling caused by the anesthetic. However, this effect is typically minimal, usually less than 2 mmHg.

Do certain anesthetic agents or sedatives affect IOP more than others?

Most anesthetics and sedatives tend to lower intraocular pressure (IOP), while some others may increase it. Medications that help reduce anxiety before an eye examination can be appropriate. However, a veterinary ophthalmologist can recommend the most suitable medication based on the specific needs of the pet.

If the eye has discharge, can you do a saline wash before the measuring or will that affect the test?

Kcs (dry eye) and severe ocular inflammation can cause a sticky surface, which should always be washed with a sterile eye wash before measuring. Discharge might affect the bounce of the probe, which can affect the reading. Saline washes will not affect the reading.

Can an eye with an ulcer be measured, and how much can acute ulcers affect IOP?

A measurement should not be taken when a cornea has weakened tissues, as with deep and/or infected ulcer, a corneal perforation, or a descemetocoele. This can cause the eye to rupture/perforate. Even gentle eyelid manipulation can cause a weakened cornea to perforate.

What setting should I use to measure a species not included in the TONOVET calibrations?

Whenever measuring an animal for which we do not have a specific calibration, it is up to the user to choose the setting and analyze the results. We cannot recommend anything that we do not have validation for. Although our species settings are calibrated for the cat, dog, rabbit, horse, mouse, and rat, our tonometers are widely used on several other species. As a rule of thumb, we recommend using the setting (calibration) closest to the eye size, with some restrictions: the cat setting should always be used on felines only.

Which tonometer is easier to use on horses?

The TONOVET Plus and pro are more user-friendly for measuring horses compared to the original TONOVET, which struggled to measure at a downward angle due to the probe ejecting from the device. The TONOVET Plus allows for horizontal positioning, along with slight upward and downward adjustments. Meanwhile, the TONOVET Pro offers 200 degrees of positional freedom and probe release control, making it even easier to position for measuring horses.

Is there advice for left-handed users of TONOVET Plus?

TONOVET Plus is used by left-handed customers. During the measurement, it is most important not to look at the display, but to concentrate on the probe's distance from the eye. We say this to all customers regardless of their preferred hand to use. Red/green lights will guide you in positioning the probe correctly. The sound will inform you when the IOP measurement is finished. Customers can also swing the TONOVET Plus, so the display is facing upwards. Alternatively, the TONOVET Pro has a screen on the back of the unit, facing the user. We still advise that during the measurement, you concentrate on the probe's distance from the eye and not the display.

Why do environmental conditions, specifically humidity, tend to affect the performance of my device?

In colder temperatures or high humidity, it is recommended to remove the tonometer from its case to allow it to acclimate to the current environmental conditions. If it is used immediately, especially in humid environments, condensation may be present in the probe base, which can interfere with its movement. This condensation will dissipate within a few minutes if the tonometer is allowed to adjust to its surroundings.



Learn more about TONOVET rebound tonometry.

Visit tonovet.com to explore the complete TONOVET product portfolio, clinical studies, and educational resources supporting accurate IOP measurement.

