

The efficacy for functional evaluation of feline hereditary rod cone degeneration using a portable mini-Ganzfeld electroretinography unit



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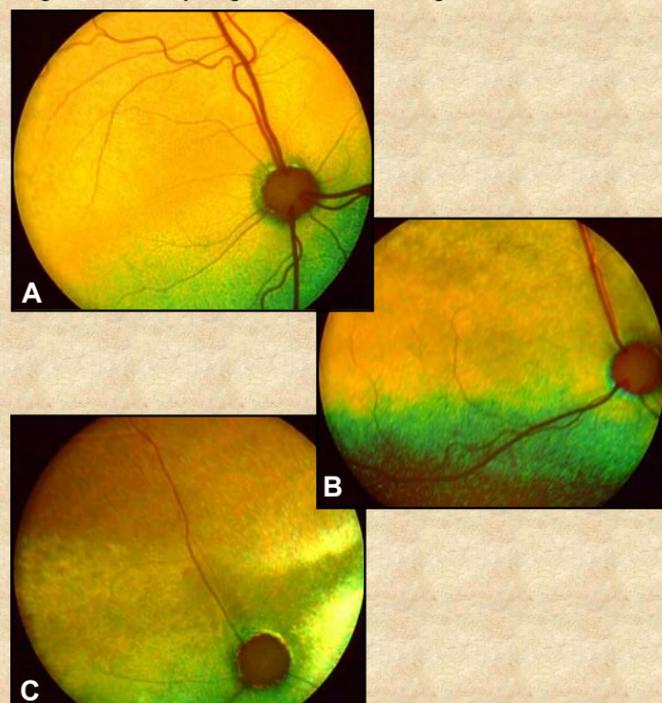
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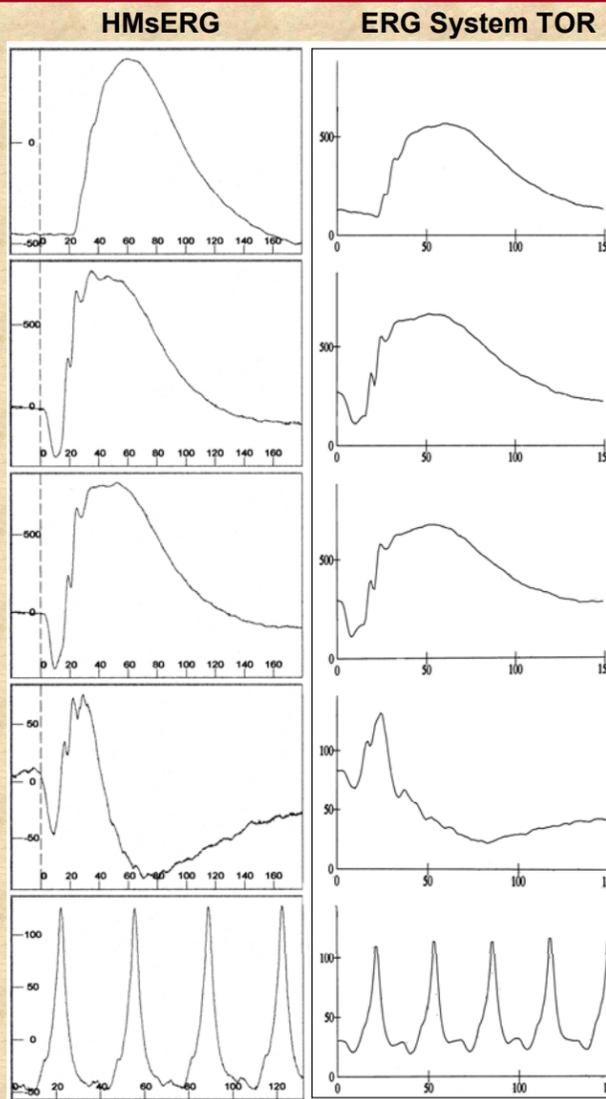
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Background: Objective evaluation of retinal function is often needed in the clinical and research environment. We studied normal cats and cats affected with different stages of inherited rod cone degeneration¹ to evaluate the efficacy for obtaining a diagnosis with a new portable mini-Ganzfeld ERG unit, using it in parallel with a conventional table-top Ganzfeld ERG. Previous studies, with large ERG equipment and extended protocols, have shown that a significant reduction in scotopic high intensity a-wave amplitude²⁻⁴ together with a corresponding increase in b/a wave ratio is diagnostic for early stage feline rod cone degeneration⁵.



Methods: Eleven affected cats in different stages of disease (S2 - S4; early (A), moderate (B) and advanced (C)), and four normal controls were anesthetized using a combination of medetomidine (0.09 mg/kg, IM) and ketamine (5 mg/kg, IM) and studied using the protocol recommended by ISCEV for diagnostic ERGs⁶ in humans. Cats were dark-adapted overnight and prepared under red lights. Scotopic ERGs were first obtained using a conventional tabletop unit (ERG System TOR, Global Eye Program, Rejmyre, Sweden). Before light adaptation, the units were switched and the small, portable ERG (Handheld multispecies ERG; HMsERG, RetVet Corp. Inc., Columbia, MO) was used, with the ISCEV protocol, followed by photopic recordings using the larger unit. A- and b-wave amplitude and implicit times were evaluated along with waveform shape, b/a-wave ratios and oscillatory potentials (OPs). The latter were obtained from responses to high intensity stimuli under scotopic conditions through digital filtering at 100 to 300 Hz. The table shows light stimulation parameters used with the two different ERG units.



Results: Figure (left) shows results of ERG tracings using the HMsERG and the TOR units, respectively, in a case of early stage hereditary retinal degeneration. In affected animals, the mean amplitude of the scotopic a-wave using 3 (HMsERG) and 1 cd.s/m² (TOR) respectively, of white light stimulation was significantly lower already in early disease: 197 ± 82 μV using the HMsERG (p=0.004) and 116 ± 44 μV for the TOR unit, when compared to results of controls: 559 ± 115 μV and 307 ± 65 μV, respectively. Similarly, significant differences between affected early stage cats and controls were found for the b-wave amplitudes, although not as marked (p=0.014 for the HMsERG) when using this level of light stimulation. For the b/a-wave ratios of affected cats, these were also significantly increased (p=0.037 for HMsERG) in early disease compared to those of normal cats using both units. A- and b-wave implicit times, were not found to be diagnostic when comparing early stage affected and normal cats using either equipment, and 3 and 1 cd.s/m², respectively, of light intensity stimulation. OPs were reduced in affected cats in comparison to those of normal cats (data not shown) using both instruments. The ERG waveform shapes obtained using the portable unit were comparable to those of the conventional tabletop unit (Figure, left).

Conclusion: The portable mini-Ganzfeld HMsERG provided results that were remarkably similar to the conventional tabletop full-field ERG System TOR in normal and affected animals. Although subject to further evaluation, this study shows the efficacy of the portable unit in the diagnosis of generalized photoreceptor disorders. Additional work is underway to establish reference ranges using the portable ERG for research and in the clinical practice.

HMsERG		ERG System TOR	
Light Intensity / Stimulation (white LEDs)	Mean amplitude μV (Standard Deviation)	Light Intensity / Stimulation (Xenon flash)	Mean amplitude μV (Standard Deviation)
Scotopic 0.01 cd.s/m ²	b-wave: 774.8 (341.8)	Scotopic 0.01 cd.s/m ²	b-wave: 487.5 (156.5)
Scotopic 3.00 cd.s/m ²	a-wave: 197.3 (82.2) b-wave: 1118.5 (344.9) b/a-wave ratio: 6.3 (1.8)	Scotopic 1.00 cd.s/m ²	a-wave: 116.0 (44.0) b-wave: 562.8 (172.8) b/a-wave ratio: 4.7 (1.1)
Scotopic 10.00 cd.s/m ²	a-wave: 247.5 (100.6) b-wave: 1169 (344.6)	Scotopic 4.00 cd.s/m ²	a-wave: 129.6 (56.3) b-wave: 576.5 (213.4)
Photopic 3.00 cd.s/m ² with 30 cd/m ² background	a-wave: 43.0 (16.5) b-wave: 133.3 (58.8)	Photopic 1.00 cd.s/m ² with 30 cd/m ² background	a-wave: 8.9 (5.1) b-wave: 69.3 (36.8)
Photopic 30Hz at 3.00 cd.s/m ² with 30 cd/m ² background	b-wave: 136.0 (47.9)	Photopic 30 Hz at 1.00 cd.s/m ² with 30 cd/m ² background	b-wave: 70.4 (33.6)

Light stimulation parameters and mean ERG a- and b-wave amplitudes (μV) ±SD for the HMsERG and for the ERG System TOR, respectively, in early stage of feline rod cone degeneration.

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