Haryana Vet. (March, 2022) **61(SI)**, 34-36 **Research Article**

ELECTRO-DIAGNOSTIC EVALUATION OF RETINA IN HEALTHY DOGS

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ABSTRACT

The present study was conducted on 30 clinically healthy dogs (60 eyes) to standardise the HMsERG system and to establish ERG system-specific limits. All the dogs were divided into 3 groups-I (young, < 1 year old), groups-II (adult, 1-6 year old) and groups-III (senile, > 6 year old) containing 10 dogs in each group. Significant differences in relation to age were observed for the amplitudes of a- and b-wave recorded for rod, combined rod-cone and cone responses in between group-III and group-II as well as in between group-III and group-I. Significant differences ($p < 0.05$) were observed in between group-I and group-II as well as in between group-II and group-III for flicker response. Significant differences in implicit times of b-wave for cone response and a- and b-wave for combined rod-cone response were recorded in between the group-I and group-III as well as in between group-II and group-III. No significant differences were observed between the left and right eyes. ERG variables in dogs differed by age due to age-related retinal changes.

Keywords: Dogs, Electroretinography, Photoreceptor cells, Photopic, Retina, Scotopic

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Electroretinography (ERG) is a well-established diagnostic method for evaluating retinal function. (Gum *et al.*, 1984). Electrodiagnostic testing provides unique, non-invasive opportunities to probe the visual system from the retina to the visual cortex, virtually in any animal species (Sanel *et al.*, 2021). It is a test to measure the electrophysiological activity *viz.*; electrical response of eye's light sensitive cells, called rods and cones.

ERG provides a measurement of the ability of retina to change light energy into electrical energy. A typical ERG includes monitoring of scotopic responses (rod response and combined rod-cone response) of dark adapted eyes in dim light and photopic responses (cone response) of light adapted eyes and flickering (30 Hz flicker response) light stimuli (Itoh *et al.*, 2013). The ERG is considered best as a mass response of the entire outer retina to flashes of light for clinical purpose. ERG is usually used to assess outer retinal function in animals affected with disorders of the rods and cones. Although, ERGy requires sophisticated equipment and specialised training in its operation and interpretation of results, it is an extremely valuable diagnostic tool for the veterinary ophthalmologist (Ofri, 2008). The ERGy has been useful for the diagnosis and evaluation of retinal function in dogs in the presence of cataract, hemeralopia, intoxications, sudden acquired retinal degeneration and cortical blindness (Sims, 1999; Jhirwal *et al.*, 2019).

MATERIALS AND METHODS

The present clinical study was conducted in 60 eyes from 30 dogs of either sex presented to the clinics and during ophthalmic check-up camp at Department of Veterinary Surgery and Radiology, Bikaner. All the dogs under study were divided into three groups (10 dogs each) according to age: Group-I: included the young dogs of both the sexes (< 1 year old) Group-II: included the adult dogs of both the sexes (1-6 years old) Group-III: included the senile dogs of both the sexes (>6 years old). HMsERG (Hand held multispecies Electroretinography) unit (clarity easy trace) including HMsERG Amplifier, patient cable, LED flash (Ganzfeld stimulator), Koijman electrode (active), reference and ground electrodes and a display unit (Laptop and a Printer) was used for ERGy.

Prior to ERGy, all 30 dogs were examined for any pre-existing ocular disorders that may decrease visual outcome by performing various ophthalmic examinations such as menace reflex test, corneal reflex test, pupillary light reflex test, Shirmer's tear test and fluoroscein dye test. All dogs received topical 1% tropicamide for maximal pupillary dilation as mydriatic (2 drops every 10 minutes) and 0.5% Povidine Iodine for ocular antisepsis 2-3 times, 30 minutes prior to procedure. Electroretinography of retina was performed under general anaesthesia using a combination of Ketamine (@ 5.0mg/kg) and Xylazine(@ 1.0 mg/kg) for induction along with Atropine Sulphate@ 0.03mg/kg SC as premedicant and was maintained with Ketamine till effect. The dog was placed in sternal recumbency in an exclusive darkroom and head was positioned by placing a cotton pillow under the lower jaw, so that it provides stabilisation and comfort. Physiologic body temperature of animal was maintained during procedure. All the electronic devices *viz.*, mobiles, batteries,

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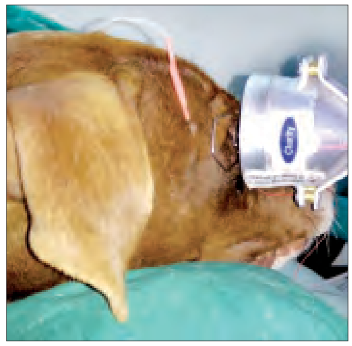
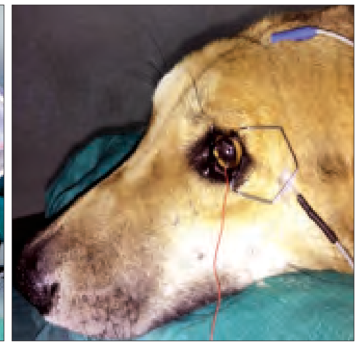

Fig. 1. Positioning of the patient Fig. 2. Positioning of ground electrode Fig. 3. Positioning of reference electrode Fig. 4. Positioning of active electrode

Table 1

Normal ranges of amplitude (µv) for the all 30 dogs according to age*

Group (Number of Eyes)		Group-I (20)	Group-II (20)	Group-III (20)
ERG Responses				
Rod	a*	62.9 (20.6-130.0)	40.8 (10.9-121.0)	31.0 (8.10-100.0)
	b*	145.0 (82.1-230.0)	133.0 (70.4-211.0)	75.3 (32.1-150.0)
Combined	a*	106.0 (70.6-166.0)	94.4 (32.4-126.0)	50.3 (15.4-95.4)
	b*	173.0 (116.0-281.0)	139.0 (52.4-182.0)	93.8 (40.3-141.0)
	b/a*	1.66 (1.08-2.12)	1.50 (1.08-2.40)	1.89 (1.25-2.62)
Cone	a*	19.9 (63.4-182.0)	72.3 (19.5-131.0)	40.8 (15.7-60.7)
	b*	174.0 (101.0-268.0)	119.0 (31.5-192)	86.5 (40.6-121.0)
	b/a*	1.77 (1.22-2.03)	1.69 (1.21-2.16)	2.01 (1.24-2.68)
Flicker	a*	13.2 (5.4-24.7)	17.7 (8.0-32.5)	11.9 (6.6-20.9)
	b*	18.2 (8.6-30.0)	19.2 (7.1-27.9)	14.3 (8.9-30.7)

*Significant difference

Table 2

Normal ranges of implicit times (ms) for the all 30 dogs according to age

Group (Number of Eyes)		Group-I (20)	Group-II (20)	Group-III (20)
ERG Responses				
Rod	a	16.9 (5.8-24.3)	14.1 (7.0-38.8)	12.3 (6.4-23.8)
	b	49.1 (36.5-66.7)	43.5 (18.2-78.8)	50.3 (15.4-79.7)
Combined	a*	18.8 (7.6-35.6)	19.8 (6.3-36.8)	13.2 (6.9-21.7)
	b*	52.2 (28.3-80.6)	48.7 (24.1-78.6)	37.6 (19.6-96.6)
Cone	a	19.2 (6.6-39.8)	15.4 (5.2-30.7)	12.4 (5.7-21.4)
	b*	52.5 (24.8-64.2)	45.9 (18.4-60.1)	33.5 (20.7-55.6)
Flicker	a	15.4 (6.4-24.7)	12.3 (7.6-36)	12.8 (7.9-18.9)
	b	27.4 (21.3-34.3)	25.1 (9.7-50.6)	24.6 (7.6-87.6)

*Significant difference

etc. were kept off to avoid electrical interference with the ERG unit. Diagnosis was performed by the individual sitting on the front of the patient. Inadvertent entry of any personnel was avoided. Positioning of electrodes and ERG recording was performed as per the guidelines of Narfstrom *et al.* (2002) (Fig. 1 to 4).

RESULT AND DISCUSSION

Menace reflex test, corneal reflex test, pupillary light reflex test was positive for all the 30 dogs. Shirmer's tear test reported a range of tear production from 15-20 mm/min in all eyes under study. Fluoroscein dye test was found negative in all the 30 dogs. Jeong *et al.* (2013) also performed pre-diagnostic test such as menace reflex test, corneal reflex test and pupillary light reflex test before recording of ERG to rule out any ophthalmic disorder. Pupillary dilation of all 30 dogs were achieved by the instillation of two drops of 1% tropicamide every 10 minutes for 30 minutes and pupil remained dilated throughout the procedure in all the cases. Safatle *et al.* (2005) also used 1% tropicamide to dilate the pupil of eye in dogs. In the study, an exclusive room was earmarked for this procedure and standard protocols as per ISCEV were followed. Honsho *et al.* (2004) had also advised the necessity of an exclusive room for the application of the ERG. Corneas were protected with non-irritating solution, such as hypromellose cellulose as advised by Narfstrom *et al.* (2002). In the present study, a standard anesthetic protocol was applied to all patients to avoid the sounds from environment and the artifacts that can develop due to patient's movement.

The anaesthetic protocol used was found suitable and no complications due to anaesthesia were encountered in the study. The anaesthetic protocol was in accordance with Jeong *et al.* (2013). However, other anaesthetic protocol had also been used by various scientists *viz.*, Kommonen *et al.* (2007) and Lin *et al.* (2009). In the present study, significant differences in relation to age were observed for the amplitudes of a- and b-wave recorded for rod, combined rod-cone and cone responses in between group-III and group-II ($p < 0.05$) as well as in between group-III and group-I ($p < 0.01$). For flicker response, significant differences ($p < 0.05$) were observed in between group-I and group-II as well as in between group-II and group-III (Table 1-2). This reduction in amplitude might be due to ocular media alteration (pupil size) with decrease effective intensity of the stimulus (Birch and Anderson, 1992), decrease photoreceptor density (Weleber, 1981) and bipolar or Muller cell death (Curcio *et al.*, 1993) and reduction in photopigment sensitivity might be an influential factor in dogs (Kolesnikov *et al.*, 2010).In the present study, no significant differences in implicit times of a- and b-wave for rod and flicker response and a-wave for cone response were observed whereas significant difference ($p<0.05$) in implicit times of b-wave for cone response and a- and b-wave for combined rod-cone response were recorded in between the group-I and group-III as well as in between group-II and group-III (Itoh *et al.*, 2013).

In the current study, no significant differences in values for the left and right eyes in the same subject were observed (Itoh *et al.*, 2013). The difference in the results of present study with other authors might be due to presence of various breeds and degree of pupil dilatation in the groups as reported by Acland and Aguirre (1987).

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