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Physiologic Values of Tear Secretion in Bozova Greyhounds According to Gender and Age

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Abstract: The aim of this study was to determine physiologic Phenol Red Thread Tear Test (PRT) values in Bozova greyhounds raised in Bozova Province of Sanliurfa, Turkey, in order to investigate possible differences between left and right, males and females eyes. The study was performed on 12 greyhounds ranging from 5 months to 7 years of age and from 11-25 kg body weight. A strip of PRT was placed inside the lower eyelid approximately one-third the distance from the temporal to nasal canthus. For moistening the test strips were left for 15 sec. While the eyelids were held closed. The mean length of the wet area of the strips was 27.79±3.49 mm. There were no significant differences in tear production between males and females or eyes of right and left hand sides. PRT was foud to be a comfortable method which could be easily performed on a routine basis and without pain for measurement of tear production in greyhounds. The normal PRT values found would clinically help diagnosis of Kerato Conjunctivitis Sicca (KCS) in greyhounds.

Key words: Bozova greyhound, phenol, red, secretion, tear

INTRODUCTION

Keratoconjunctivitis Sicca (KCS) or dry eye is a chronic inflammatory disease notably characterized by the deficient production of the aqueous portion of the tear film (Grahn and Storey, 2004; Anderson, 2000). It is a common disorder of an incidence ranging from 11-14.7% in dogs (Andrade and Laus, 1997).

In dogs several causes can result in a reduced tear production. Breed predisposition, canine distemper, congenital and iatrogenic factors, chronic blepharoconjunctivitis, excessive tear evaporation, parasitic migration, drugs effects, trauma of eye and orbit, neurogenic diseases, metabolic diseases such as hypothyroidism, hyperadrenocorticism and diabetes mellitus are considered to be the most common cause of KCS (Grahn and Storey, 2004; Beech *et al*., 2003; Ribeiro *et al*., 2008). However in most cases the disease is idiopathic in which T lymphocytes involve (Kaswan *et al*., 1985; Sansom and Barnett, 1985; Smith, 2005).

Canine thelaziosis caused by *Thelazia callipaeda* (Spirurida, Thelaziidae) is an arthropod-borne disease caused by a nematode that infects at both the adult and larval stages, the eyes of domestic and wild carnivores and humans. In the infected animals, the presence of worms may induce different degrees of clinical signs, ranging from lacrimation and conjunctivitis to keratitis, epiphora, eyelid oedema, corneal ulcers and blindness (Anderson, 2000; Otranto and Eberhard, 2011).

Irritation and gritty feeling in the eye, discomfort or less frequently, ocular pain are common presentations of the disease. These symptoms are usually considered as a result of diminition of tear production (Kaswan *et al*., 1995; Nelson *et al*., 2000). A mucopurulent ocular discharge, superficial corneal vascularization, corneal edema, pigmentary keratitis, diffuse conjunctival hyperemia and reduced vision can also be observed. Corneal damage may lead to blindness (Beech *et al*., 2003; Crispin, 2000).

KCS is often misdiagnosed by the clinician as bacterial conjunctivitis and commonly treated with different topical antibiotics. The patient improves while treated but the clinical signs reappear days or weeks after the withdrawal of the treatment. The condition progresses to severe corneal opacities and lately to blindness (Herrera, 2005).

The disease can be diagnosed via Break Up Time (BUT), Schirmer Tear Test (STT) and Phenol Red Thread Tear Test (PRT). The BUT evaluates the time in which the precorneal tear film shows punctate dry spots after

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instillation of a drop of fluorescein while the eye is held in an open position. Normal BUT values are about 15-20 sec (Ribeiro *et al*., 2008; Herrera, 2005).

The other method for measuring tear production is STT which easily and quickly performed by inserting a special study strip into the conjunctival fornix for 1min and the results are reported as milimeters (Beech *et al*., 2003; Brightman *et al*., 1983). Two types of the STT have been described (SST-1 and SST-2). The STT-1 measures basal and reflex tear production and is the most commonly used test (Grahn and Storey, 2004; Barabino *et al*., 2004). The STT-2 evaluates basal tear production after topical application of an anesthetic and is of predictive values in animals with corneal ulceration which do not tolerate the STT-1 (Saito and Kotani, 2001).

An alternative method for the estimation of tear production in dogs is the phenol red thread test. The principle of this technique is similar to that of the STT but the test lasts only 15 sec (Grahn and Storey, 2004; Saito and Kotani, 2001). The phenol red test consists of a thread of 75 mm in length soaked with phenol red which is a pH indicator. The thread is placed in the lower conjunctival fornix for 15 sec and the alkaline tears change its color from yellow to orange. The examiner can use the millimeter scale printed on the box of the strips (Barabino *et al*., 2004). Reference values for dogs range from 30-38 mm/15 sec (Grahn and Storey, 2004; Saito and Kotani, 2001).

To the knowledge, no study has been performed to determine physiologic tear test values by using PRT in greyhounds. The aim of this study was to determine PRT values in greyhounds in order to investigate possible differences between males and females or left and right sides.

MATERIALS AND METHODS

The study was performed on 12 greyhounds ranging from 5 months to 7 years of age and from 11-25 kg body weight. The greyhounds raised for hunting in Bozova Province of Sanliurfa in Turkey. The greyhounds included into the study had no sign of corneal or conjunctival disease and without any history of ocular disease. All measurements were carried out on greyhounds in March 2010. Temperatures during this period were 20-30°C. No analgesic or anaesthetic was used for PRT measurement.

The strips used (Zone-Quick; Menicon Inc., Clovis, CA, USA) were a 75 mm long cotton thread folded 3 mm at the end. For the measurement by PRT, the eyelid of each greyhound was pulled out gently by using an ophthalmic forceps and the strips were placed into the lower conjunctival fornix approximately one-third the distance from the temporal to nasal canthus and left for 15 sec for moistening. During the application of the thread, the eyelids were held closed and the thread was removed after 15 sec. The color of the thread soaked with phenol red turned from pale yellow to red by absorption of the slightly alkaline tear.

The length of the wet area on the thread was measured and the results were recorded in mm. All tests were performed by the same person. Any variation in absorptive capability of the threads was minimized by using only PRT tear test threads from the same lot number. The data were compared between the eyes of left and right sides and sex groups. Statistical analyses of data were performed by Two Sample t-test in Minitab 12.1 Software package.

RESULTS AND DISCUSSION

The results obtained from Bozova greyhounds are shown in Table 1. The mean length of the wet area in greyhounds was 27.79±3.49 mm/15 sec ranging from 21-37.

The mean PRT values of left and right eyes were 28.42±3.80 and 27.17±3.19 mm/15 sec, respectively. The difference was statistically not significant ($p>0.05$).

The mean PRT values in males and females were 28.29±4.07 and 27.10±2.51 mm/15 sec, respectively. The difference were stastitically not significant ($p>0.05$).

The tears value can be measured via PRT in the dogs, cats, horses and other animals (Saito and Kotani, 2001). No report about physiologic thread tear values in greyhounds was found in the literatur. Therefore, the results of this study has been discussed with those from studies on dogs.

Aqueous tear production is routinely measured in dogs with STT strips. There is a range of results reported for adult canine STT-1 values including 21.3±3.8 mm min^{-1} (Wyman *et al*., 1995), 18.89±2.62 mm min^{-1} (Saito and Kotani, 2001) and 18.64±4.471 mm min^{-1} (Hirsh and Kaswan, 1995). Sanchez *et al*. (2006) said that STT-1 measurements of 11-14 mm/min were considered moderately low and readings of equal to or <10 mm min^{-1} should be considered low in dogs. Saito and Kotani

Table 1: Total PRT values in Bozova greyhounds

Groups	N	X±Sx (mm/15 sec)	Minimum	Maximum
Total	24	27.67±3.81	21	37
Left eye	12	28.42±3.80	23	37
Right eye	12	27.17±3.19	21	32
p-value		NS		
Male eyes	14	28.29±4.07	21	37
Female eyes	10	27.10±2.51	23	32
p-value		NS		

NS: Not Significant ($p>0.05$)

(1999) reported that PRT values of normal dogs belonging to five different breeds were 26.9±3.0 mm. The PRT values foundin Shih-Tzu dogs were 28.2±4.3 mm. Grahn and Storey (2004) and Saito and Kotani (2001) have reported that PRT reference values for dogs ranges from 30-38 mm/15 sec. The mean values observed in greyhounds were 27.79±3.49 mm/15 sec. The results of the present study are similar to those reported by Saito and Kotani (1999). The difference between the results of this study and those of (Grahn and Storey, 2004; Saito and Kotani, 2001) might be due to the breeds studied, season of the study and environmental conditions. Beech *et al.* (2003) reported that tear production would be maximum in Winter.

According to Saleh *et al.* (2006), a cut off point of 5 or 10 mm is considered as KCS positive, when STT or PRT is used, respectively. In the present study, the measurements ranged from 21-37 and were higher than those reported by Saleh *et al.* (2006) for affected animals because healthy greyhounds were used in this study.

Berger and King (1998), Moss *et al.* (2004), Giannetto *et al.* (2009) reported that STT values decreased with age in normal animals. It might be supposed that reduction in functional capacity of the lacrimal and nictitans glands with age would result in a decrease in tear production. Kaswan *et al.* (1991) reported an increasing incidence of KCS in animals aged 10-15 years. Some studies (Smith *et al.*, 1994; Kaswan *et al.*, 1998; Margadant *et al.*, 2003) found no significant difference in STT values among age groups. In the present study a comparison among age groups could not be performed because the number of animals in age groups was insufficient. On the other hand healthy animals were used in this study. Berger and King (1998) have reported an increased tear production in heavier dogs. There were not obese greyhound in this study.

Some studies (Sanches *et al.*, 2006; Smith *et al.*, 1994; Kaswan *et al.*, 1998; Margadant *et al.*, 2003) indicated no significant differences in STT values between sex groups. However, others (Grahn and Storey, 2004; Sansom and Barnett, 1985; Barnett and Sansom, 1985; Barnett, 1988) reported an increased incidence of KCS in female dogs (Andrade and Laus, 1997; Barnett, 1988; Barnett and Joseph, 1987). Barnett and Joseph (1987) reported an increased susceptibility to experimentally drug-induced KCS in female dogs compared to male dogs. It is known that lacrimal glands are larger in males than females (Grahn and Storey, 2004). Nevertheless, there were no significant differences in tear production between males and females eyes in this study.

In this study no difference was found in PRT values between the eyes of right and left hand sides. The results of the study are in accordance with those of Claudia *et al.* (2009) and Hollingsworth *et al.* (1992) who have not observed any statistically significant difference in STT values between the left and right eyes in the dogs. The result obtained in the second eye is not apparently affected by the stimulation of basal secretion in the first eye (Wyman *et al.*, 1995).

Schirmer tear test is the most commonly employed method in animals (Wyman *et al.*, 1995). For measurement by using STT the strip should left 1 min and some times STT-2 must additionally be applied. The type of strip employed for STT may also influence the result (Saito and Kotani, 2001; Wyman *et al.*, 1995; Saleh *et al.*, 2006). However, PRT is a more easily applicated and painless diagnosis method of KSC compared to STT since PRT needs only 15 sec together. There were no report on the measurement of tear production by using PRT in greyhounds. Therefore, researchers could not compare the results with those on greyhounds.

CONCLUSION

PRT measurement was found to be a suitable method which could be easily and rapidly performed without pain in greyhounds. There were no significant differences in tear production between males and females or eyes of right and left sides. Further studies with larger sample size are required to investigate the effect of other factors such as age and season on tear production in greyhounds raising in the region.

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