

## AGE CHANGES IN THE ORGAN OF VISION IN DOGS

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There is no information in the literature regarding the condition of the organ of vision and the course of diseases of the eyes in dogs at different age periods. Only the anatomical structure of the eyes and certain eye diseases and their treatment have been described [1, 2], yet the age changes in the organ of vision in dogs must be taken into consideration when the action of toxic substances is being studied. The object of the present research was to study the age changes in the organ of vision of dogs not previously used for experimental purposes.

### EXPERIMENTAL METHOD

An ophthalmological examination was carried out on 112 dogs, aged as follows: under 1 year – 37 dogs, from 1 to 2 years – 23, from 2 to 3 years – 13, from 3 to 4 years – 12, from 4 to 5 years – 7, from 5 to 6 years – 9, from 6 to 7 years – 3, from 7 to 8 years – 2, from 9 to 10 years – 3, and over 10 years – 3 dogs. Hence, nearly 2/3 of the dogs examined were young (under 3 years) and 36 dogs were aged from 4 to 10 years. The veterinary surgeon determined the age of the animals from their external characteristics, mainly from the state of their teeth.

Before undergoing ophthalmological examination, the dogs were kept for not less than 2 weeks in quarantine. Throughout this period observations were made on their general condition, temperature, body weight, pulse and respiration rates, and the state of their peripheral blood; their urine was tested and their stools examined for the presence of helminth ova. Dogs showing no abnormal findings were selected for the experiments.

The organ of vision of the dogs was investigated by means of an electric ophthalmoscope with a +15.0 D lens and a slit lamp. The following were examined: the skin of the eyelids, the lid margins, the lacrimal tract, the mucous membrane of the lids and the eyeball, the cornea, the anterior chamber, the iris, the border of the pupil, the lens, the vitreous body, the optic disk, and the retina and its vessels.

### EXPERIMENTAL RESULTS

The condition of the organ of vision in animals of the same age was basically similar. In dogs aged from 1 to 3 years, the skin of the eyelids and its hairy cover were unchanged; the lid edges were not thickened and were pink in color; growth of the lashes was regular. When pressure was exerted on the region of the lacrimal sac, no secretion escaped from the puncta lacrimalia. The mucous membrane of the eyelids was pink in color, with well defined vessels. The cornea was transparent. The anterior chamber was of normal depth, and its fluid transparent. In most dogs the iris was light or dark brown in color, its pigment was uniformly distributed, and the pattern of the iris was unchanged. The border of the pupil was well defined. After instillation of atropine solution (1:1000), in nearly all the dogs of this age the pupils were maximally dilated. The lens and vitreous body were transparent. The optic disk was pink, with clearly defined edges. In many dogs pigment was found around the optic disk, in the form of a narrow ring or semicircle.

As a rule in each eye the optic fundus was divided by its coloring into two halves, superior and inferior. One color changed sharply into the other, and the boundary passed nearly horizontally through the center of the optic disk or from its upper border. The inferior half of the optic fundus was dark red in color, while the upper consisted of three bands of different colors, with no sharp demarcation between one color and the next. A narrow band, bluish violet in color, was in direct contact with the inferior half of the optic fundus. Superiorly to it lay a broad band, green in color, with a bright phosphorescence. The green band was not uniform, but apparently consisted of small green, greenish-yellow, or yellow spots. Above the green strip, the optic fundus at its periphery was mainly yellow in color.

The retinal vessels in most animals emerged through the central portion of the optic disk, most commonly

passing in four directions, less frequently in three. Smaller vessels branched from the central vessels. The arteries of the retina were dark red in color. The veins were wider and darker than the arteries. The ratio between the calibers of arteries and veins in most animals was approximately 2:3.

Investigation by means of the slit lamp showed that in the dogs aged 1 year the lens was faintly smoky in color, with a large embryonic nucleus, ill-defined sutures and subcapsular zones. In the two year old dogs, the lens was still faintly smoky in color, but with clear subdivisions by means of greyish sutures; the embryonic nucleus appeared smaller in size than in the dogs aged 1 year, and the subcapsular zones were wider. In the three year old dogs the lens was smoky in color, with clear zones of division; the sutures were grey in color with a yellow hue. In the dogs aged 4-5 years the state of the organ of vision as revealed by ophthalmological examination was fundamentally no different from that described in the dogs up to 3 years of age. However, in a few dogs at 4 years of age, and in almost 50% of the five year old dogs, at the border of the cornea an ill-defined arcus senilis could be seen. The iris and the pupillary margin of the dogs aged 4 years showed a very slight decrease in the amount of pigment. At the pupillary margin there were solitary small (pin-prick) areas, grey in color and free from pigment. In the five year old dogs these areas also appeared in the iris. In most dogs 4-5 years of age the pupils dilated readily by the action of 1:1000 atropine solution, in some dogs to the limit. In the four year old dogs the lens nucleus showed a slight increase in optical density, or sclerosis, more pronounced in the five year olds. In no dog under 6 years of age were the initial stages of a senile cataract observed. The optic fundus in dogs aged 4-5 years was almost identical with that in the younger animals. In the light of the slit lamp, the lens in the dogs of this age group was yellowish in color, its zones of division were clearer, and its sutures were yellow or yellow-orange in color, with slightly increased optical density.

Starting from the age of 6 years, many changes began to take place in the condition of the organ of vision, and these were seen more frequently the older the dogs. For instance, in all dogs aged 6 years or over, an arcus senilis was observed at the border of the cornea, varying in its intensity. The pigment content of the iris was decreased, larger areas of a greyish color appeared, and the lacunae of the iris became wider. The pupillary border was appreciably thinner, and contained numerous small grey areas, free from pigment. After instillation of 1:1000 atropine solution, the pupils dilated readily, but weakly in some dogs. Sclerosis of the nucleus of the lens gradually increased. In some dogs opacities appeared in the infero-medial or infero-lateral segments of the lens, mainly in the form of spicules with their pointed ends facing the center of the lens, and their base facing the periphery (senile cataract). No ripe cataracts were observed in dogs under 10 years of age.

In some six year old dogs a slight pallor was observed at the margin of the optic disk. In old dogs the disk became pale pink in color, with a yellowish hue.

In the superior half of the optic fundus of the six year old dogs the bluish-violet coloration disappeared or persisted only as very slight traces, and the green band had lost its color and become brighter, and in the older dogs was replaced by a yellow or yellow-orange band. Moreover, in the superior half of the optic fundus of some dogs, some mainly round foci with clearly defined edges were observed, solidly yellow-orange-red in color, with a bright luster, and ranging in size from a millet seed to the diameter of the optic disk. The vessels above these foci remained unchanged. The older the dogs, the larger and more numerous the foci with a marked luster. Sometimes they coalesced to form areas exceeding in size the diameter of the optic disk. Furthermore, around the optic disk appeared a rim or crescent of the same luster as in the foci. As a rule a semicircle was observed at the superior border of the optic disk. As the dogs grew older, the retinal arteries became narrow and tortuous, and the veins slightly dilated and stretched.

In the light of the slit lamp, the lens of the six year old dogs was yellow in color. With age, the yellow color of the lens was intensified and it became coarser in structure; the sutures of the lens and the subcapsular zones increased in optical density and appeared yellow-orange or even orange-red in color. In the dogs aged 8-10 years, between the embryonic and ripe nucleus a narrow ring of condensation of a yellow-orange-red color was observed. As a rule, in the light of the slit lamp, the opacities discovered in the lens were irregular, and greyish or greyish-white in color. Between the dense areas of the opacities there were semitranslucent aqueous spaces of different sizes. These opacities were more frequently found beneath the anterior capsule of the lens, and less frequently beneath the posterior capsule; only very rarely did they lie along the course of the sutures.

These findings demonstrate that the organ of vision in dogs undergoes age changes which can be detected clearly by means of the slit lamp.

#### SUMMARY

Ophthalmological examination was conducted in 112 dogs. The age of 73 of them ranged from 1 to 3 years, of 36 – from 4 to 6 years; 3 dogs were over 10 years of age.

In electro-ophthalmoscopy of dogs aged from 1 to 3 years, no peculiarities connected with the age were noted in the external portion of the eye, the refractive media or the optic fundus. At the same time some age peculiarities were detectable with the aid of a slit lamp. The lens of one year old dogs was light grey in color with weakly manifested division zones and a large embryonic nucleus. In two year old dogs the lens sutures were marked, but optically not dense. In three year old dogs the lens sutures already exhibited slight density.

In some dogs, aged 4 to 5 years, there were a weakly manifested senile arch along the edge of the cornea and reduction of pigment in the iris and pupil margin. In dogs aged 6 years and older, there were a marked senile arch, the presence in the iris and pupil margin of small areas devoid of pigment, sclerosis of the lens and in some cases an incipient senile cataract. Apart from this, a yellow staining of the optic papilla, atrophic foci of the retina of yellowish-orange color with a marked luster, and vascular sclerosis were noted.

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