

Luxatio lentis in dogs: a case report

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ABSTRACT: The material of the present study was composed of 30 eyes with luxatio lentis occurring in 20 dogs. Unilateral lens luxation was determined in a half of the animals while bilateral luxation was determined in the other half. Lenses in 19 of the 30 eyes were luxated in the anterior direction (63.3%), three were luxated in the posterior direction (10%) and eight were subluxated (26.6%). The distribution of patient dogs based on the breeds showed that the incidence of lens luxation was higher in Terrier, Cocker Spaniel and crossbreed dogs compared to the other breeds. The results of etiological classification of the diseases which are generally seen in older dogs (on average 7.2 years old) were as follows: congenital in two patients, primary luxation in four patients, and secondary luxation in 14 patients. Secondary luxations diagnosed in 14 animals were determined to have developed as a result of trauma in two dogs, glaucoma in one dog, uveitis in one dog, and senile degeneration and/or cataract in 10 dogs. Bilateral (two dogs) and unilateral (five dogs) intracapsular lens extraction (ICLE) was applied to these animals. The primary disease was to be kept under control by treating those with secondary lens luxation for uveitis or glaucoma. A severe progressive intraocular inflammation developed in one patient. Enucleation was conducted on this patient due to buphthalmus developing in a short time. These results may be helpful to small animal veterinarians dealing with this disease which results in blindness unless early diagnosis and surgical treatment are conducted.

Keywords: lens displacement; luxatio lentis; dog

Lens luxation is defined as the displacement of the lens from the normal position in the eye caused by rips in the zonula or suspensor ligaments. Subluxation of the lens, generally occurring at early stages of luxation, is the case resulting from partial degenerations or destructions in which the motility of the lens is limited but it remains in the normal position (Curtis, 1990; Naisse and Glover, 1997).

Lens luxations resulting from damage to the zonula are classified as congenital, primary and secondary luxations (Willis et al., 1979; Glover et al., 1995; Pizzirani, 1998). Those occurring as a result of traumatic effects can be evaluated in a separate group (Curtis, 1990; Lazarus et al., 1998). Some authorities classify luxations in four groups, namely as senile luxation, Terrier lens luxation/subluxation syndrome, traumatic luxation and secondary luxation (Curtis, 1990; Naisse and Davidson, 1999). Congenital luxations can occur alone or along with other congenital defects (Bedford, 1980; Curtis, 1990; Pizzirani, 1998).

Two different abnormal developments have been determined in the fibra zonularis as zonular fibril dysplasia caused by abnormal protein structures and zonular fibril collagenization. It has been reported that zonular fibril dysplasia is more common in dogs (Morris and Dubielzig, 2005). This disease which results in primary lens luxation is considered to be caused by a single autosomal recessive gene. The results of previous studies conducted with Tibet terriers (Willis et al., 1979), miniature bull terriers (Curtis and Barnett, 1983), and Shar-Pei (Morris and Dubielzig, 2005) support this opinion. Primary lens luxation is more commonly seen in middle-aged dogs (i.e. 4–5 years old) as bilateral luxation.

No gender predisposition has been reported (Curtis, 1990; Glover et al., 1995; Martin, 2005). Lens luxation has been known to be hereditary in many small-sized dog breeds, particularly in small Terrier breeds. These breeds include German hunt Terrier, Tibet Terrier, Gal Terrier, Fox Terrier, Jack

Russel Terrier, Dandie Dinmont Terrier, Australian Coli, Basset Hound, Beagle, Chihuahua, German Shepherd, Greyhound, miniature Poodle, and miniature Schnauzer (Curtis, 1990; Stades et al., 1998; Martin, 2005).

Secondary lens luxation can occur as a result of anterior uveitis, cataract, glaucoma, and other intraocular diseases including neoplasia, all of which cause damage, degeneration or inflammation of the zonula. As the intraocular pressure (IOP) constantly increases, ocular layers may be stretched and the ocular globe may expand (hydrophthalmus). These conditions may result in the occurrence of tears in the fibrils of the zonula. In this case, the lens begins swimming freely in the front compartment or in another area (Curtis, 1990; Naisse and Glover, 1997). As glaucoma may cause secondary luxation, secondary luxation may also cause glaucoma. In subluxation or complete anterior luxation, the lens may enter the pupil and block it resulting in an increase in the intraocular pressure. The constriction of the iridocorneal angle leads to the occurrence of glaucoma (Bedford, 1980; Curtis, 1990; Glover et al., 1995; Naisse and Glover, 1997; Pizzirani, 1998; Gelatt and MacKay, 2004). Secondary luxations are more commonly seen in older dogs (Curtis, 1990; Naisse and Glover, 1997).

The first clinical symptoms seen in anterior luxations include acute epiphora and blepharospasm. Corneal oedema develops immediately in the case of the contact of luxated lens with the endothelium of the cornea. This lesion may be permanent even after the lens removal. If the lens is not removed, diffuse oedema and vascularization occur in the cornea. In anterior luxations of lens, various symptoms caused by fast-developing glaucoma may be seen. For example, the vitreous may be herniated towards the front, which is one of the causes of an increase in the intraocular pressure (IOP). In chronic luxations, cataract begins to develop and can be diagnosed easily (Curtis, 1990; Pizzirani, 1998; Martin, 2005).

Occasionally, the lens may be luxated backward toward the vitreous. If the complete ventroposterior displacement of the lens occurs, the fundus may be seen by the naked eye (Curtis, 1990; Pizzirani, 1998; Stades et al., 1998). Subluxation may progress asymptotically. The typical finding of this condition is iridodonesis, which can be defined as the weakness and vibration of the iris caused by the lack of physical support provided by the frontal surface of the lens. This finding can be observed

only when the ocular globe is moved and accepted as a pathognomical symptom.

The diagnosis of the disease can be easily done by a careful ophthalmoscopic examination of the eye. Ocular ultrasonography may be useful if the intraocular structures cannot be seen due to severe opacity of the cornea (Curtis, 1990; Pizzirani, 1998; Martin, 2005).

In the treatment of the disease, the lens that is luxated toward the anterior chamber should be accepted as an emergency case and the lens should be removed surgically within one to three days (Curtis, 1990; Stades et al., 1998; Bedford, 1980; Pizzirani, 1998). If the lens is luxated forward but is still behind the iris, the patient should be kept under control with tonometric measurements. If needed, it may be appropriate to wait until the lens exits to the anterior chamber by using therapeutics reducing the IOP, dropping of the lens into the vitreous may be facilitated by using miotics and/or latanoprost (Martin, 2005). Attempts to keep the lens in its position using a miotic agent have been reported to be unsuccessful (Curtis, 1990; Naisse and Glover, 1997).

In posterior luxations, the lens can be seen as embedded in the vitreous, non-motile and in contact with the retina. In this case, a possibility of surgical damage to the retina is considerably high. Although chances for the development of glaucoma and uveitis are lower compared to those in anterior luxation, leaving the lens as it is makes the medical treatment of the case with glucocorticoids difficult (Curtis, 1990).

Miotics can be used before the operative treatment of anterior luxations to prevent the occurrence of posterior luxations during surgery. Some physicians recommend intravenous administration of mannitol to reduce the IOP (Martin, 2005). The effect can be enhanced by the oral use of carbonic anhydrase inhibitors (CAI) (diclorphenamide) or miotic agents (pilocarpine, demecarium bromide). The preoperative use of corticosteroids is useful for limiting the inflammations that may develop during or after surgery (Curtis, 1990).

The lens is removed operatively by intracapsular lens extraction (ICLE) (Bedford, 1980; Curtis, 1990; Pizzirani, 1998; Martin, 2005) and phacoemulsification (Curtis, 1990; Martin, 2005). In general, the intracapsular method is similar to the extracapsular lens extraction method used for the treatment of cataract. However, ICLE is used for the anterior lens luxation treatment. In the ICLE technique,

the dislocated lens is totally removed. In the extracapsular technique, to prevent the vitreal prolapse the posterior lens capsule has to be intact. But the anterior lens capsule and cataractous lens material are removed in the extracapsular technique. In an ICLE operation, the use of mydriatics before surgery should be avoided in the anterior luxated lens. In cases of anterior luxation, miotic drugs may be used to constrict the pupil in order to prevent the lens moving posteriorly during the ICLE. On the contrary, mydriatics should be used to see and manipulate posterior luxated lenses. The first entrance to the anterior chamber should be exercised carefully. Otherwise, if the fluid flow is faster, the prolapsus of the vitreous and separation of the retina may occur (Curtis, 1990; Naisse and Glover, 1997). Most physicians prefer a lateral canthotomy incision because a 160–170 degree-wide corneal incision is required during ICLE. If the lens is situated in the posterior segment, there is a risk of further movement in the posterior direction during ICLE. A Calhoun-Hagler double-pronged needle may be inserted through the pars plana to pass behind the lens as a precaution (Curtis, 1990). Some researchers prefer the cryoextraction technique in which the capsule and fibrils underneath are frozen and completely removed (Bedford, 1980; Stades et al., 1998). During the ICLE procedure, vitreal attachments of the lens have to be cut with scissors. It is very important to avoid retinal detachment and glaucoma secondary to vitreal prolapsus (Curtis, 1990). Posterior luxation is treated conservatively with topical glucocorticoids in most instances. These patients have to be controlled periodically against increases in the intraocular pressure (Martin, 2005).

In the phacoemulsification technique, there is an advantage of a smaller incision (3 mm) to the cornea (Naisse and Davidson, 1999). Phacofragmentation uses ultrasound to break up the lens material which is then aspirated from the eye (Ozgencil, 2005). This technique can be performed on an anteriorly luxated lens. If phacoemulsification is performed on hard subluxated cases, the lens material can escape into the vitreous. In the case of subluxations they are not treated surgically until the lens is completely luxated (Martin, 2005).

Following the removal of the lens by successful surgery, blurred vision may develop due to the insufficient focusing of refracted light on the retina. However, it has been reported that no clear loss of vision occurs after surgery. The use of lens prosthe-

sis has been considered as an alternative approach. ICLE should be applied in the treatment of secondary luxations because glaucoma and intraocular inflammation may develop. A surgical technique used for the treatment of secondary luxations is the same as that described for primary luxations. However, surgery of secondary luxation is less problematic due the lack of vitreal connections (Curtis, 1990).

Complications that may occur during the ICLE surgery include bleeding and herniation of vitreous. Postoperative complications are glaucoma, development of intraocular fibrin, and retinal detachment (Glover et al., 1995; Pizzirani, 1998). It has been reported that within 4–6 weeks after the ICLE, the retina separation has been seen in 14% of the patients. Laser retinopexy may be used following ICLE as a prophylactic approach for reducing this risk (Martin, 2005).

O'Reilly et al. (2003) applied cyclophotocoagulation with an iodine laser to 15 dogs with glaucoma that developed after ICLE. The researchers reported that the technique was useful when the results of the first three months were evaluated. They further reported for the long-term results that repeated transscleral cyclophotocoagulation might have been required for some patients in which IOP increased. Following the technique, the authors recommended the use of topical dorzolamide, latanoprost, and/or systemic carbonic anhydrase inhibitors to maintain low IOP.

In the present study in which our clinical cases of lens luxations are evaluated, we intended to share our experiences with this disease that is commonly seen in dogs and that may result in blindness.

MATERIAL AND METHODS

The material of the present study was composed of 30 eyes with luxatio lentis from 20 dogs that were brought to the clinics of Department of Surgery, Faculty of Veterinary Medicine, Istanbul University. The breeds of the dogs were: four Terriers, three crossbreeds, three Cocker Spaniels, two German Shepherds, two Poodles, one Siberian Husky, one Pekingese, one German Shorthaired Pointer, one Samoyed, one Miniature Pincher, and one Boxer. Fifteen dogs were males while the remaining five dogs were females. The age of the patients varied between six months and 15 years.

Systematic ophthalmic examinations were applied to the dogs that were brought to our clin-

ic with complaints including vision loss, colour change in the eye, and photophobia. In some patients, physical examinations were conducted and haematological and biochemical blood profiles were evaluated. After luxating, locations of the lenses were determined as anterior, posterior, or subluxation. These cases were classified as congenital, primary, and secondary luxations based on the race of the patients, history of the complaints, and ophthalmoscopic findings. The animals diagnosed with secondary luxation were further classified into subgroups according to the reasons underlying the development of luxation, i.e. trauma, uveitis, glaucoma, senile degeneration, and/or cataract.

ICLE was applied to the patients as bilateral in two dogs (both the cases were primary luxated lenses), and as unilateral in five dogs. In two patients with secondary luxation, attempts were made to keep the primary disease under control by treatments for uveitis or glaucoma. In one patient, severe intraocular inflammation developed which could not be taken under control. In this patient, enucleation was conducted due to fast developing buphthalmus. In one patient (Samoyed), ICLE was contraindicated due to bilateral buphthalmus. Due to the localization of the lenses, the operation was not indicated in four cases (4, 7, 11, 14). An operation was suggested to the owners for other five cases (2, 3, 5, 9, 17), but due to the age and financial problems they did not accept the operation.

An increase in the intraocular pressure was determined in nine eyes to which ICLE was decided to be applied. The five patients with unilateral lens luxation were treated with CAI combined with latanoprost drops for three days before the surgery. To the other two patients with bilateral lens luxation intravenous 20% mannitol was administered (1 mg/kg) a day before the surgery. No preoperative mydriatic was applied to these two patients due to the fact that in both cases the lenses were completely or largely in the front compartment.

Following the entrance to the front compartment using a cornea knife (slit, 45° angled), incisions varying between 150° and 170° were made using left-hand and right-hand cornea scissors. Hydrodissection was employed for the removal of lens. During the removal of lens, prolapsed vitreous was determined in three of the seven eyes and removed with vitreous vitrectomy scissors in the anterior chamber. Following the irrigation of the anterior chamber, corneal incisions were closed by separate sutures using 8/0 polyglactine 910

(Vicryl®, Ethicon, Edinburgh, United Kingdom). For the postoperative care, systemic antibiotics for the first five days, local corticosteroid and antibiotic eye drops for two to three weeks (four times a day) were applied to the patient dogs. For those patients with high IOP, latanoprost and/or local CAI were used. Plastic collars were used in all patients for three to four weeks to prevent them from harming themselves.

RESULTS

After completing the examinations, 10 patients were diagnosed with bilateral lens luxation and the other 10 dogs were diagnosed with unilateral lens luxation. Nineteen (63.3%) of the 30 eyes with lens luxation were in the anterior direction, eight (26.6%) were in the subluxated position, and three (10%) were in the posterior segment. As for the distribution of dogs according to the race, numbers of Terrier, Cocker Spaniel, and crossbred dogs were higher than those of the other breeds (Table 1). The average age of dogs affected by the luxation of the lens was 7.2 years. Lens luxation was more common among middle-aged and older dogs.

Based on the anamnesis, race information, clinical symptoms, haematological and biochemical profiles, congenital lens luxation was diagnosed in two dogs, primary lens luxation in four dogs, and secondary lens luxation in 14 dogs. It was noteworthy that 12 of the patients with lens luxation were ≥ 8 years old. In 14 patients with secondary lens luxation, two cases were caused by a trauma, one case was due to glaucoma, one case was due to uveitis, and 10 cases were due to senile degeneration and/or cataract.

In a dog (six months old German Shepherd) that was diagnosed with congenital lens subluxation bilateral iridodonesis was the first symptom to attract our attention. Due to the localization of the lenses, the operation was not indicated in this case. The owner was told that the lenses could be completely separated from their places in future, therefore follow-up controls were essential. In the other dog (nine months old German Shorthaired Pointer) diagnosed with congenital bilateral luxation notable symptoms were development of cloudiness in both eyes and iridodonesis that was particularly clear in the left eye. In the ophthalmoscopic examination of this dog, local oedema and vascularization resulting from endothelial degeneration were observed

Table 1. Description of cases with luxatio lentis

No.	Breed	Age (years)	Sex	Side	Classification	Localization	Treatment
1	Terrier	6	female	unilateral	primary	anterior chamber	ICLE
2	Terrier	8	male	bilateral	secondary	anterior chamber × 2 (both)	OR
3	Terrier	15	female	unilateral	secondary	anterior chamber	OR
4	Terrier	14	female	unilateral	secondary	subluxation	C
5	Crossbreed	12	male	unilateral	secondary	anterior chamber	OR
6	Crossbreed	1	female	unilateral	secondary	anterior chamber	E
7	Crossbreed	8	female	bilateral	secondary	subluxation posterior segment	C
8	Cocker Spaniel	8	male	bilateral	secondary	anterior chamber × 2 (both)	ICLE
9	Cocker Spaniel	9	male	bilateral	secondary	subluxation anterior chamber	OR
10	Cocker Spaniel	8.5	male	unilateral	secondary	anterior chamber	ICLE
11	Poodle	11	male	unilateral	secondary	posterior segment	C
12	Poodle	8	male	unilateral	secondary	anterior chamber	ICLE
13	German Shepherd	8	male	unilateral	secondary	subluxation	C
14	German Shepherd	6 months	male	bilateral	congenital	subluxation × 2 (both)	C
15	Siberian Husky	2.5	male	unilateral	secondary	anterior chamber	ICLE
16	Pekingese	5	male	bilateral	primary	anterior chamber × 2 (both)	ICLE
17	German Shorthaired Pointer	9 months	male	bilateral	congenital	anterior chamber posterior segment	OR
18	Samoyed	6	male	bilateral	primary	anterior chamber × 2 (both)	C
19	Miniature Pincher	5	male	bilateral	Primary	anterior chamber × 2 (both)	ICLE
20	Boxer	9	male	bilateral	Secondary	subluxation × 2 (both)	C

ICLE = intracapsular lens extraction, OR = owner's refusal, E = enucleation, C = contraindication



Figure 1. Corneal oedema and vascularization due to luxated lens

(Figure 1). Immediate surgery was recommended to the owner for the right eye but he did not accept the operation.

One Samoyed, one Pekingese, one Miniature Pincher (bilateral) and one Terrier (unilateral) diagnosed with primary lens luxation were middle-aged dogs. In the anamnesis of the dog of Samoyed breed it was reported by the owner that the problems had been lasting for the last six months. After the examination, the owner was told that the treatment could not be successful since the case was chronic and IOP was high (more than 40 mm/Hg for both eyes). We found out later that the dog was operated in a private clinic elsewhere and the result was not successful. The others in this group were operated by ICLE. During the operations, luxated lenses were easily removed. However, the prolapsed vitreous was determined. The lens that



Figure 2. First luxated lens was cloudy in Case 19

luxated first lost its transparency in bilateral cases (Figure 2). Short-term results in the Pincher were determined as bleeding in the fundus of the first luxated eye. The ophthalmoscopic condition in the other eye was better. There was an improvement in the vision of the patient as well as in the quality of life. However, in the 6-month long-term follow-up control, enophthalmos in the first luxated eye and separation of the retina in the other eye were diagnosed. The patient's vision improved in a short time following surgery; however, it declined gradually and was completely lost after six months. In the dog of Pekingese breed, the vision improved significantly within the first week following surgery. In the first luxated eye, permanent oedema developed as a result of endothelial degeneration hindering the vision. The corneal oedema in the eye was remarkably recovered in the first three weeks and the vision of the patient by this eye was preserved. In long-term follow-up controls conducted every six months, the occurrence of pigmentation along the incision line was determined in the 1st year and progression in pigmentation for four years. Until this period, the vision was preserved despite some limitations. As the patient reached the age of nine years, pigmentation completely blocked the pupillary entry resulting in the loss of vision. A mild corneal oedema emerged as a postoperative short-term complication yet recovered well within 2–3 weeks in the Terrier. The owner was advised to follow up the lens in the other eye due to potential development of lens luxation in that eye as well.

Secondary lens luxation was diagnosed in 14 patients. Ten of these lens luxation cases developed due to senile degeneration and/or cataract. The race distribution of the 10 patients was three Terriers, three Cocker Spaniels, two Poodles and two cross-breed dogs. Five of the dogs were diagnosed with bilateral lens luxation whereas the other five with

unilateral luxation. All of these dogs were older than eight years and the average age was 10.1. In three of the patients, there were lens luxations with no cataract development. Lesions existed in both eyes. The remaining seven patients were suffering from long-term cataract with hypermature cataract appearance. With the exception of one patient (14 years old, female Terrier), the other patients had either bilateral luxation (four cases) or unilateral luxation accompanied by cataract in the other eye (two cases).

In a patient diagnosed with senile degeneration and/or cataract dependent lens luxation (eight years old, male Cocker Spaniel), the lens in the right eye was cloudy and collapsed in the ventral direction behind the iris. In the examination of this patient's fundus, total retinal detachment was determined. In the other eye, the lens filled the anterior chamber by luxating forward. The owner was told that the retina separation could be bilateral although the fundus was not visible in the examination. Upon the owner's request, ICLE was applied to this eye. Corneal oedema developed postoperatively yet recovered in three weeks and enabled an examination of the fundus (Figure 3). Although no complication occurred in the operated eye, total retinal detachment was determined in that eye like in the other. ICLE was applied to one patient of Cocker Spaniel breed and one patient of Poodle breed in which unilateral lens luxation was diagnosed. Postoperative corneal oedema recovered within 2–3 weeks. Since lens luxation in both dogs was chronic (longer than two months) and lenses were in contact with the rear surface of the cornea, mild oedema in the cornea remained constant due to corneal endothelial degeneration. Vision in these eyes was significantly improved compared to the preoperative period.

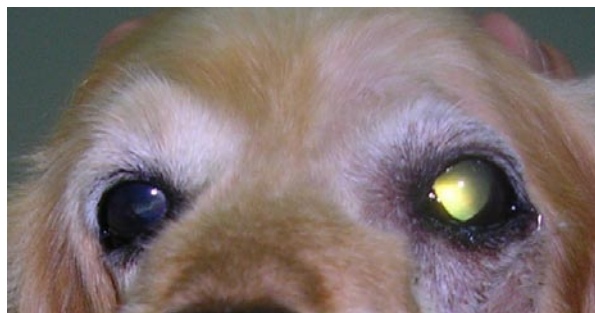


Figure 3. Tapetal reflection was seen but the retina was detached in the left eye in Case 8 (three weeks after operation)



Figure 4. Immediately postoperative view of Case 15

Due to the localization of the lenses, the operation was not indicated in three cases (4, 7, 11) with secondary lens luxations. Operative treatment was recommended to four patients (2, 3, 5, 9) diagnosed with secondary lens luxation but the owners did not accept the operation.

Four of these secondary luxations developed due to trauma, uveitis and glaucoma. Clinical symptoms observed in these animals were as follows: the eye of a one-year-old crossbred dog was traumatized resulting in a severe intraocular inflammation. Therefore, ICLE could not be applied to this patient. Although anti-inflammatory treatment was continued, the case was accompanied by an increase in the intraocular pressure. At the end of the second week, the eye had a condition resembling buphthalmus. As a result, the eye was enucle-



Figure 5. Postoperative view of Case 15 (three weeks after operation)

ated. The other patient was a dog of Siberian Husky breed 2.5 years of age. When brought to the clinic, traumatic uveitis was diagnosed. The lens was subluxated and iridodonesis was present. Local and systemic anti-inflammatory treatment was started on the patient. Weekly follow-up controls indicated that lens luxation progressed in the anterior direction. 15 days after the first clinical examination, total luxation occurred and ICLE was applied (Figure 4 and 5). In one (eight years old German Shepherd) of the other two dogs subjected to secondary lens luxation, one of the lenses was in the subluxated position due to bilateral uveitis. In the nine years old Boxer, both lenses were subluxated due to bilateral glaucoma. The clinical condition of the patients was taken under control with medical treatment and no operation was conducted.

DISCUSSION

Although lens luxation may occur in a variety of dog races due to different causes, it has been known that Terrier dogs are predisposed to this disease (Curtis, 1990; Glover et al., 1995; Pizzirani, 1998; Stades et al., 1998; Martin, 2005). In the present study, 20 patients were evaluated and the largest group with 20% of all patients was Terrier supporting the previous information. Although lens luxation was classified for its aetiology by different methods, in general, the disease has three types, namely congenital, primary and secondary luxation (Willis et al., 1979; Pizzirani, 1998; Glover et al., 1995). We determined that secondary luxation was the most frequently occurring type of the disease with 70% incidence rate. This finding was in agreement with that reported by Fischer (1989). Curtis et al. (1983) reported primary luxation to be the most frequently seen. As the secondary luxations of lens are reviewed, it has been reported that their primary cause can be glaucoma, uveitis, trauma, senile degeneration, hypermature cataract, and intraocular tumours. With the exception of neoplastic aetiology, we encountered all causes of secondary luxations. Keeping in mind that hypermature cataract and senile degeneration may exist at the same time in older animals, we evaluated both causes together and concluded that the primary cause of luxation was senile degeneration and hypermature cataract in these types of patients. This finding is in parallel with the finding that secondary luxations develop more frequently in older animals (Glover

et al., 1995). Another issue that drew our attention was that the owners of the animals in which senile degeneration and/or cataract induced luxation was diagnosed generally hesitated to accept the operation. In addition to the concerns about advanced age, anaesthesia, and economic aspect of the operation, it was noteworthy that the owners tended to accept the loss of their dogs' vision.

Despite the absence of gender predisposition, there were some common features among middle-aged patients with bilateral primary lens luxation (Curtis, 1990; Glover et al., 1995; Martin, 2005) in a four-case group. Primary luxation was bilateral in three patients and unilateral in one patient. The owner of the latter patient that was a Terrier was informed that luxation would most probably develop in the other eye.

Congenital lens luxation, which has been characterized as the least frequent type of luxation (Glover et al., 1995), can occur alone or together with other ocular defects (Bedford, 1980; Curtis, 1990; Pizzirani, 1998). In the present study, congenital luxations were the least frequently seen type as well. The luxations were bilateral in both cases. It was characterized by subluxation in the German Shepherd, and by total luxation of one lens to the anterior chamber and the other to the vitreous in the German Shorthaired Pointer. There was no other ocular defect in these dogs.

In their 57-case study Glover et al. (1995) reported the frequency rates of anterior, posterior luxation and subluxation as 46%, 14% and 40%, respectively. Although different rates were reported in other studies, in our study the frequency rates were ranked from the highest to the lowest as anterior (63.3%), subluxation (26.6%) and posterior (10%).

The most common complication of lens luxation, particularly in the anterior one, is a fast developing intraocular pressure (Bedford, 1980; Curtis, 1990; Glover et al., 1995; Pizzirani, 1998; Stades et al., 1998; Gelatt and MacKay, 2004). The influence of subluxations and posterior luxations on the increase in intraocular pressure is weaker (Glover et al., 1995). Sometimes, subluxation may progress asymptotically (Curtis, 1990; Pizzirani, 1998; Martin, 2005). Our findings are in agreement with this information. In addition to the fast developing intraocular pressure, the contact of the lens with the endothelial layer of the cornea which results in permanent corneal oedema, highlights the importance of immediate surgical treatment (Bedford, 1980; Curtis, 1990; Pizzirani, 1998; Stades et al., 1998).

In the present study, the main disadvantage that we encountered in terms of the results was that a large proportion of the cases were in chronic stage. O'Reilly et al. (2003) reported that transscleral cyclophotocoagulation was useful in patients that developed glaucoma after ICLE. Following the technique, the authors recommended to use topical dorzolamide, latanoprost, and/or systemic carbonic anhydrase inhibitors to maintain the low IOP. For our cases, we used latanoprost and/or systemic carbonic anhydrase inhibitors before or after the operations to keep the intraocular pressure low. According to our observations, even if the intraocular pressure that increased at the preoperative stage was lowered and the postoperative increase in the intraocular pressure was taken under control, the second leading cause responsible for the loss of vision is the oedema induced by permanent endothelial damage in the cornea.

Due to the localization of the lenses (Table 1), the operation was not indicated in four cases (4, 7, 11, 14) in our study. Operations were suggested to the owners for five cases (2, 3, 5, 9, 17), but due to age and financial problems they did not accept the operations. Medical management and periodical control is very important for this kind of cases.

The separation of the retina is a problem that may develop postoperatively and may result in blindness, as we saw in a patient (Pizzirani, 1998; Martin, 2005). As we observed in the Pekingese patient, pigmentation may develop along the incision line on the cornea postoperatively. The occurrence of this complication should be monitored and kept under control, especially in brachycephalic breeds.

In conclusion, early diagnosis and appropriate treatment are the most important factors for handling lens luxations that generally develop due to secondary causes in middle-aged and older dogs. In the present study which involves 30 eyes from 20 dogs, we attempted to share our observations on etiological classification of lens luxations, luxation types, clinical findings and treatment options with our colleagues.

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