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Comparison of rigidpolymethylmethacrylate and foldable square edgeacrylic lens replacement for management of cataract after phacoemulsification in 22 eyes of dogs

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ABSTRACT

The clinical study was conducted on 22 eyes of 18 dogs (16 male and 2 female)to evaluate efficacy of Phacoemulsification for cataract removal and feasibility of rigid and foldable intraocular lens(+41 D) implantation in dogs. Animlas were operated under general anaesthesia using diazepam @ 0.5mg/kg b.wt and ketamine @ 5mg/kg b.wt combination and maintained on isoflurane inhalation anaesthesia. Animals were divided in two groups. In group I (n=5) rigid IOL polymethylmethacrylate (PMMA) was used and in group II (n=17) square edge foldable acrylic lens was used. Cataractic lenses were removed by phacoemulsification using coaxial operating microscope. The animals were reviewed for surgical outcome, intraoperative and postoperative complications. Success rate was determined by dividing the number in which successful restoration of vision was observed with the total number of the eyes operated for cataract surgery and lens implantation. The results showed that restoration of functional vision was noted in 1/5 (20%) and 11/17 (64.70%) in group I and Group II respectively at the end of the study. Intraoperative complications observed were hyphema andmiosis in both groups however these complications were significantly lower in group II. Postoperative complications included corneal opacity, uveitis and corneal oedema in both the groups but severity of the complications were lower in group II.To conclude intraocular foldable lens implantation with +41D following phacoemulsification was found comparatively effective technique with success rate of 64.70% for management of mature cataract in dogs.

Key words: Cataract, Corneal opacity, Foldable lens, Phacoemulsification.

INTRODUCTION

Cataract is a leading cause of unilateral and more often bilateral (Fig 1) blindness in dogs. The only effective mean of its treatment was surgical extraction of diseased lens (Dziezyc 1990) and its replacement by an artificial intraocular lens. Cataract extraction is one of the ophthalmic surgeries frequently performed in veterinary medicine(Azar and Rumelt, 2000). Over the years, the technique of cataract surgery had evolved into a safe and successful procedure for visual rehabilitation of the cataract blind patients (Jhala *et al*,2009). The opinions on cataract surgery have been changing continually with advancement of the procedure. The success rate of cataract surgery had risen significantly during last decades, especially due to the development of more precise microsurgical techniques and with introduction of phacoemulsification (Gellat and Gellat, 2001) and intraocular lens (IOL) implantation. In order to achieve postoperative emmetropia, many researchers had documented the diopter (D) of IOL optic in dogs with an IOL of approximately 41 D being mainly used in canine cataract surgery (Davidson *et al*., 1993). The most widely used IOL material in veterinary practice was polymethylmethacrylate (PMMA) (Glover and Constantinescu 1997). However, the use of various IOL materials such as silicone and hydroxyethylmethacrylate (HEMA) optic IOL has also been examined. Because acrylic and silicone lenses were flexible, they can be implanted

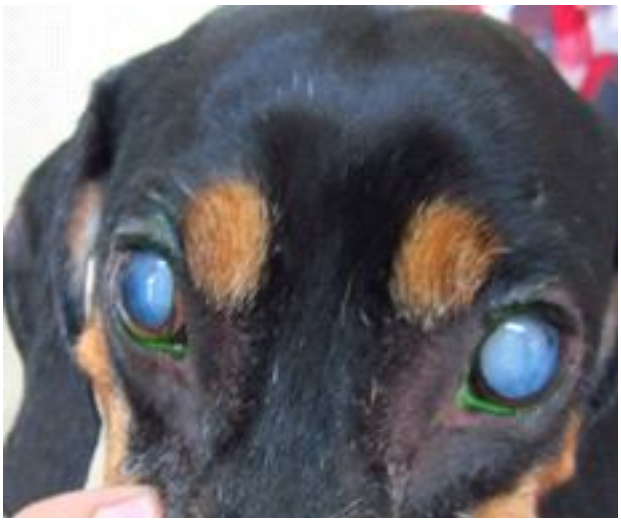

Fig 1: Photograph showing dog with a bilateral cataract (Group I)

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through a small corneal incision (2.5-2.8 mm) (Davidson 2001). This small incision reduced the surgically induced astigmatism associated the use of a PMMA optic IOL, which required a corneal incision large enough to accommodate an 8-9 mm implant. An acryl IOL with a squared edge was associated with a lower incidence of induced posterior capsular opacification (PCO) than other lens materials (Hollick *et al*., 1997). This was because acryl lenses had strong adhesion to the posterior capsule and the specific optical design (squared) can inhibit the migration of lens epithelial cells into the optic area (Davidson 2001). Flexible acryl IOLs were implanted in dogs (Gellat and Gellat 2001).In India scanty literature is available regarding cataract surgery using phacoemulsification and IOL implantation in dogs and a few systematic studies had been carried out. Therefore, this study was designed to evaluate efficacy of Phacoemulsification for cataract removal and feasibility of intraocular lens implantation in dogs.

MATERIALS AND METHODS

The present study was conducted with cataract in one or both eyes on 22 eyes in 18 dogs (16 male and 2 female) with phacoemulsification and intraocular lens(+41 Diopter) implantation was done. The animals were divided in two groups .In group I, phacoemulsification and implantation of rigid polymethylmethacrylate (PMMA) was done in five eyes (5 dogs). PMMA lens is a non foldable sterile intraocular lens with central optic diameter of 5 mm in length and overall length of 12.50 mm.The anterior chamber depth (AC depth) for the lens was 5 mm. Group II, consisted of 17 eyes (13 dogs) in which phacoemulsification and implantation of hydrophilic 360^0 square edge acrylic foldable lens was carried out. The lens had a central optic diameter of 6 mm and an overall length of 12 mm. The AC depth value of the lens was 5 mm.The dogs undergoing cataract surgery were subjected for recording signalment (age, gender and breed), stages of cataract, surgical outcome, intraoperative and postoperative complications. Preoperatively, a complete ophthalmic examination including a Schirmer tear test (STT), applanation tonometry, fluorescein staining test, direct and indirect ophthalmoscopy, A- mode ultrasonography and Pachymetry were performed in all dogs of both the groups. Complete blood examination and blood biochemistry (BUN, serum creatinine, ALT and blood glucose) were also carried out depending upon the presentation of the case. During pre-surgical preparation, all dogs received topical antibiotic agent (Genatmicin) and mydriatics (1% tropicamide). Dogs were premedicated with Glycopyrolate @ 0.01mg/kg, Acepromazine maleate @0.05 mg/kg combined with Butorphenol @ 0.2 mg/kg intramuscularly. Induction was performed using Diazepam @ 0.5mg/kg body weight and Ketamine @5mg/kg body weight combination intravenously "toeffect" followed by a maintenance with 1 to 2% isoflurane. Dogs were positioned in lateral recumbency with the eye planned for surgery being kept dorsally. Head was carefully stabilized with surgical drapes. Cataract surgery was performed using phacoemulsification unit with aid of operating microscope. Surgical site was prepared aseptically and the surgical area was draped carefully toensure globe exposure during the surgery (Fig 2). An incision was made at the cornea with a 2.8 mm angled keratotome. Trypan blue (Omni Lens Pvt Ltd.) dye was used for effectively staining the anterior lens capsule. The anterior chamber volume was restored with hydroxyl propyl methyl cellulose – a viscoelastic material (Omni Lens Pvt Ltd.). A modified curved 23-gauged needle was used to cut into the anterior lens capsule, followed by an anterior continuous curvilinear capsulorhexisusing lens capsule forceps. Part of anterior lens capsule, approximately 6-8 mm in diameter, was carefully torn and removed. Hydrodissection was performed afterwards to release any attachment between the remaining lens capsule and lens cortex using 5 ml syringe filled normal saline solution.Phaco tip was introduced through the corneal incision through the anterior lens capsule opening to chop and sculpt the cataractic lens. Irrigation and aspiration were used towards the end of the surgery to remove the remaining lens materials from the equatorial and posterior lens capsules.The procedure used a single piece of IOL of 41Diopter (D) of non flexiblepolymethylmethacrylate (PMMA) in group I and flexible, injectable and acryl polymer optic and polypropylene haptics in group II. For PMMA lens incision was made wider to accommodate 7-8 mm implant.The incision was closed by in simple interrupted sutures using Polyglactin 6/0. The acrylic IOL had a square edge. The IOL optic was folded using IOL-holding forceps and inserted into the IOL cartridge. After filling the capsular bag and anterior chamber with normal saline, the IOL in the cartridge was inserted into the capsular bag with the IOL inserter without enlarging the corneal incision (Fig 3). After surgery, cefotaxime (AlkemLab.Ltd.) @ 25 mg/kg and

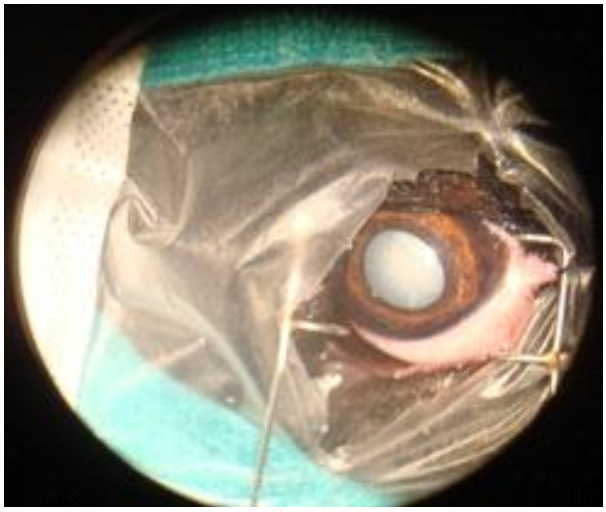

Fig 2: Photo graph showing fixing of eye ball (Group I)

Meloxicam(Intas Pharmaceuticals Ltd) @ 0.2 mg/kg body weight were administered intramuscularly for 7 and 3 days respectively. Gatifloxicin – Prednisolone (Cipla Ltd.)drops were instilled topically after every 2 hours for first week .This dose was tappered 4 hourly for 2nd week , four times a day for 3rd week and two times a day for 4th week. The dogs undergoing phacoemulsification were examined for any postoperative complications. A successful surgical outcome was defined as restoration of functional vision, assessed by response to a menacing gesture and the ability to navigate an obstacle course. Success rate was determined by dividing the number of eyes that successfully restored the vision with the total number of the eyes operated for cataract surgery and lens implantation.

RESULTS AND DISCUSSION

During the observation period, the phacoemulsification and implantation of IOLs was performed on 22 eyes in 18 dogs. In group I, all the dogs were of 5 to 8 years of age range. In group II, age range of 6 to 10 years had highest incidence 53.3% followed by 0 to 3 years 33.3% and 3 to 6 years 13.3%. Ramani *et al* (2013) had reported that the age group of 7 to 15 year had the highest incidence (50.22%) of cataract, followed by 0 to 3 year age group dogs (19.5%) and 3 to7 year age group dogs had incidence of 30.80%. Cataract was seen more in males (100%) in group I and in group II cataract was found in (84.61%) males and (15.38%) in females. Ramani *et al* (2013) found incidence of 52.6% of cataract in males and 47.4% in females. Group I showed higher incidence of cataract in Labrador (60%) followed by Pomarenian (40%) while as in group II higher incidence was seen in German Sphered (46.6%) followed by Labrador breed and Pomeranian (20% each) and Beagle and Dasschund (6.6% each). Rajasekaran *et al.*(2007) reported that per cent of cataract in Spitz as38.27%, Non-descript 23.46%, Labrador retriever 11.11%, Lhasa apso 7.41%, German 6.17%, Boxer, Dachshund, cocker spaniel, Doberman pincher, Dalmatian 2.47% and Chippiparai1.5%. The higher incidence of cataract in Labrador and German shepherd in present study may be due to the popularity of this breed in this region. Majority of dogs had bilateral cataract (93.3%). These findings were in accordance with Tuntivanich and Tuntivanich (2003). The type of the cataract was determined to be congenital in 1 /5 (20%), acquired in 4/5 (80%) in Group I. Type of cataract in group II was diabetic in 4/17 (23.52%) and acquired in 13/17 (76.47%). In two of the cases cataracts were staged as immature while rest of the cataracts were mature. The mean preoperative intraocular pressure (IOP) ± SD was 16.25± 3.34 mmHg and 20.32± 2.56 mmHg in group I and II respectively. The mean axial length of globe determined by A- scan was 22.8±0.15mm in Group I and 21.1±0.11mm in group II. Pachymetry gave indication about the health status of cornea and mean central corneal thickness was 0.60±0.03mm in group I and 0.65±0.01mm in group II. The mean Schirmer's tear test (STT) reading was 20.0±2.56mm/min in group I and 23.30±2.41mm/mingroupII, giving indication about the status of lacrimal apparatus, (Table 1) The blood glucose level in four dogs was above normal and were already on Insulin adminstration, in rest of the dogs the blood glucose level was within normal limits. Rest of the heamatobiochemical parameters were well within the normal range in all the dogs.

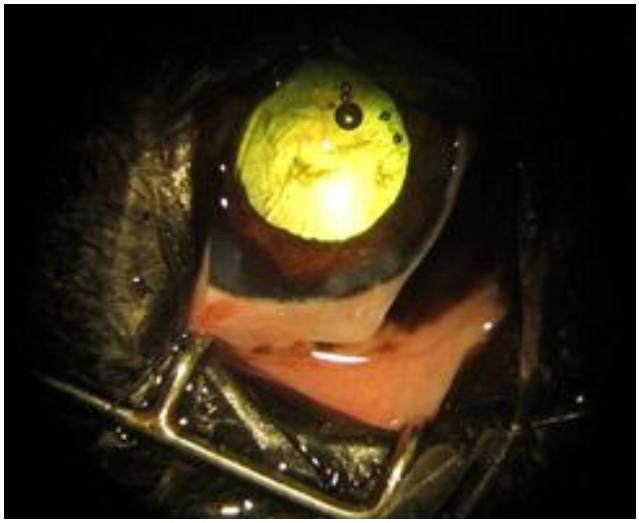

FIG 3: Photograph showing eye with artificial IOL implanted. (Group II)

One out of 5 eyes (20%) in group I and eleven out of 17 (64.70%)in group II regained visionwithin a mean time of 15 days. Menace response had become positive. These dogs passed all patterns of maze test in light room conditions.

Table 1: Preoperative calculation of different parameters in 22 Cataractic eyes.

Serial No.	IOP mmHg	Axial Length of Globe (mm)	Central corneal thickness (mm)	Schirmer's Tear Test (mm/min)	Type of cataract	Stage of cataract
Group I (n=5)	16.25± 3.34	22.8±0.15	0.60±0.03	20.0±2.56	Congenital (n=1) Acquired(n=4)	Mature(n=5)
Group II (n=17)	20.32± 2.56	21.1±0.11	0.65±0.01	23.30±2.41	Diabetic (n=4) Acquired (n=13)	Immature (n=2) Mature(n=15)

n= no of eyes.

Their vision remained until the last day of evaluation. Several intra-operative complications occurred at different point of time during the surgery were blood in the anterior chamber (hyphema) and Pupil constriction (miosis) (n=4) in group I however these complications were found in less number of dogs (n=2) in group II.The potential complications of canine phacoemulsification surgery were numerous and include corneal edema, corneal opacity, corneal ulceration, uveitis, glaucoma, posterior capsule opacification and lens fiber regrowth, posterior capsular tears, vitreous loss, lens drop, retinal detachment, endophthalmitis, and wound dehiscence (Gaiddon *et al*., 1997).In this study the most common post operativecomplication seen was corneal opacity (Fig 4) and uveitis in both the groups but the severe post operative complications were observed in group I (n=3). In group II (n=2) slight corneal opacity and uveitis was seen. Corneal opacity was seen along the incision line in group I, in which rigid PMMA lenses was implanted due to larger incision as compared to cases in which foldable lenses were used. Dogs developing slight corneal opacity got resolved within 2 weeks of time andrestoration of vision was seen (Fig 5), however 80% of dogs in group I and 35.29% in group II did not regained vision due to severe corneal opacity. Jhala *et al.*, (2009) also reported development of corneal opacity in eyes undergone extracapsular cataract extraction,however, the corneal opacity resolved within 3 weeks of time.The non restoration of the vision in group I in present study may be attributed due to large corneal incision for accommodation of rigid lens and more trauma caused to the eyes which could have damaged the corneal endothelium and resulted in severe corneal opacity and corneal oedema.In group II there was restoration of vision in 64.70% eyes suggestive of the fact that implantation of the square edge acrylic foldable lens was easy to implant and caused less trauma .Uveitis was another post operative complication.Uveitis was a common cause of secondary glaucoma following cataract surgery. In this study, only a mild uveitis was seen in the operated eyes in the first 3 days after surgery which was managed by using topically Atropine drops. Phacoemulsification was reported to reduce the severity of postoperative lens induced uveitis due to shorter surgical time and more adequate removal of lens cortex than other techniques (Wilkie and Wolf, 1990). Moore *et al* (2003), also reported that the most frequently observed complication within 48 hours postoperative was uveitis, recorded in 72% of eyes.

To conclude, phacoemulsification with square edge acrylicfoldable +41D intraocular lensimplantation was found an effective technique with success rate of 64.70% for management of mature cataract in dogs.

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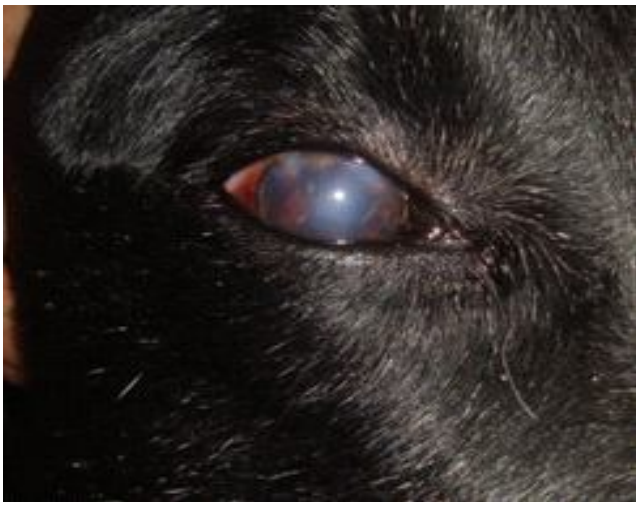

Fig 4: Photo graph showing corneal opacity 15 days post surgery. (Group II)

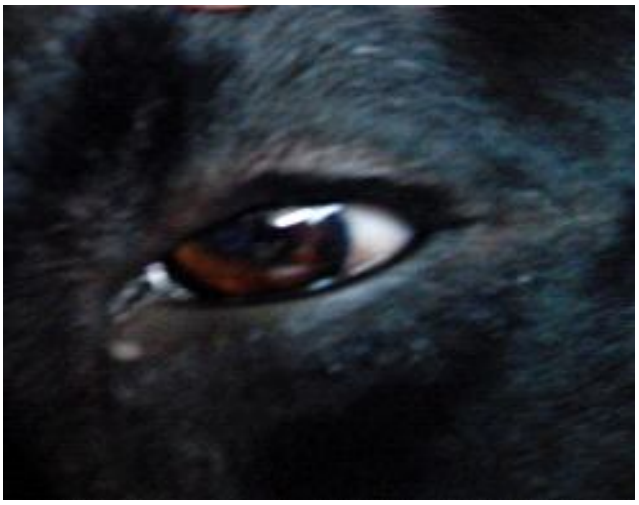

Fig 5: Photo graphshowing clear eye with IOL implanted 30 days post surgery (Group II)

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