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Studies on influence of capsular tension ring (CTR) on intraocular lens (IOL) implantation following phacoemulsification in cataractous dogs

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Abstract
The objective of the present study was to study the efficacy of implantation of hydrophobic acrylic foldable intraocular lens (IOL) following Capsular Tension Ring (CTR) placement in decreasing the occurrence of posterior capsular opacification (PCO) after phacoemulsification in cataractous dogs. Six client-owned dogs with mature cataract were selected for the study. In all animals, any ophthalmic or systemic concurrent disease was excluded prior to selection for the study. The eyes were randomly selected to receive IOL in association with CTR. Clinical evaluations were conducted on day 0, 1st, 3rd, 7th, 14th, 21st, 30th, 60th, 90th, 120th, 150th, 180th and 210th day. The results showed more inflammatory response, although among the parameters evaluated, solely the posterior synechiae and glaucoma were observed predominantly in the eyes. However, only 16.67% of PCO recorded in the eyes at the end of study period. These results suggest that the CTR can be useful in the prevention of the post-operative capsular opacities, with minor complications.

Keywords: Dogs, cataract, CTR, IOL, phacoemulsification

1. Introduction
Cataracts in both humans as well as canines are routinely managed by performing phacoemulsification and IOL implantation. But in both species, PCO is considered as the most common post-operative complication following the above procedure (Bras *et al*., 2006) [1]. Epithelial-mesenchymal transformation, proliferation and migration of residual lens epithelial cells (LECs) are responsible for the formation of PCO as well as can result in IOL decentration and impairment of vision (Wilkie and Colitz, 2013) [2]. There is an evidence to suggest that in addition to the design of the IOL, the use of a CTR may decrease PCO.
Initially, the capsular bag supporting ring developed independently in Japan by Hara *et al*. (1991) [3], Nagamoto and Bissen-Miyajima (1994) [4] and Hara *et al*. (1995) [5]. Mainly there were three goals held mandatory to secure IOL fixation are (i) maintaining a circular equatorial contour (ii) maintaining a transparent capsular bag and (iii) creating an anterior capsulectomy site that does not affect the overall capsule structure. Conserving the capsule contour prevents post-operative capsule shrinkage, deformity and possible IOL decentration. The placement of an open-ringed polymethylmethacrylate (PMMA) CTR in a human eye during cataract surgery was first carried out by Legler *et al.* (1993) [6]. Prevention of PCO and to facilitate IOL centration, lens instability from zonular dehiscence due to blunt trauma or surgical trauma and to prevent capsulophimosis as well as capsule contraction were considered the indications for the CTR placement (Menapace *et al*., 2000) [7]. It has been reported that a CTR will both delay the onset of PCO and decrease its overall severity (Kim *et al*., 2005) [8]. As the CTR stretches the capsular bag, it inhibits the LEC migration between the capsule and optic, because it decreases space between the posterior lens capsule and posterior face of the IOL optic (Findl *et al*., 1998) [9]. CTR implantation can be performed prior to phacoemulsification following capsulorrhexis and hydro dissection or following phacoemulsification, irrigation and aspiration or any time in between also. The purpose of the present study was to determine the safety of PMMA CTR in canine cataract patients undergoing routine phacoemulsification and IOL implantation without lens instability as well as to compare the type and incidence of any post-operative complications in eyes receiving CTRs.

2. Materials and Methods

2.1 Animal population

Six client-owned dogs suffering from bilateral mature cataract presented to the Department of Veterinary Surgery and Radiology, Veterinary College, KVAFSU, Hebbal, Bengaluru for a period of two years from November 2016 to October 2018 were included in the present study. Dogs selected for the study were received CTR as well as hydrophobic acrylic foldable IOL in one eye and other eye left as it is. The CTR was implanted inside the capsular bag after filling the bag with adequate hydroxypropyl methylcellulose viscoelastic material immediately after capsulorrhexis, followed by phacoemulsification and IOL implantation. Dogs were randomly selected for implantation of CTR either in right eye or in left eye.

2.2 Pre-operative preparation of the patient

All the dogs were withheld 12 hours for food and 6 hours for water before surgery. As a pre-operative antibiotic and anti-inflammatory, the cataractous eye was instilled topically with Ofloxacin ophthalmic solution and Flurbiprofen sodium ophthalmic solution @ 2-3 drops t.i.d for 3 days prior to surgery to reduce existing subclinical infection and inflammation and 2% homatropine hydrobromide eye drop @ 2-3 drops b.i.d for 3 days prior to surgery to achievemydriasis.

All the dogs were evaluated pre-operatively for signs of ophthalmic as well as systemic illness. Ophthalmic examinations and neurological tests for vision evaluation including visual function tests *viz*., menace response, palpebral reflex, pupillary light reflex (PLR), tracking reflex test, obstacle test, cotton ball test, dazzle light reflex, consensual reflexes were evaluated pre-operatively on day 0 and on 1st, 3rd, 7th, 14th, 21st, 30th, 60th, 90th, 120th, 150th, 180th and 210th day post-surgery in all dogs and clinical examination of the eye was carried out by naked eye examination, catoptric test, direct ophthalmoscopy, tonometry and schirmer teartest on the above mentioned follow-up period. These all tests were conducted in order to determine the visual status of the animal as well as to evaluate fundus visibility, persistency of transparency of the capsular membrane and the intactness of neurologic pathways of the cranial nerves pre-operatively and thus enable the detection of changes if any that might occur post-operatively.

2.3 Anaesthetic regimen

All the dogs were premedicated with Inj. Atropine sulphate @ 0.045 mg/kg BW, S/C and Inj. Xylazine hydrochloride @ 1 mg/kg BW, I/M. After 10 - 15 minutes, general anaesthesia was induced with Inj. Thiopentone sodium @ of 12.5 mg/kg BW, I/V and maintained by Isoflurane using Surgivet® inhalant anaesthetic machine.

2.4 Surgical procedure

Four stay sutures were placed in the bulbar conjunctiva using polyamide No. 0 for positioning and fixing of the eyeball. An incision about 3.8 mm was made at 10 O'clock position using a double bevel keratome blade of 2.8 mm for precisely introducing the phacoemulsification tip into the anterior chamber. A side port made at 2 O'clock position using 20 G MVR blade, 1.2 mm (15° angled) for introducing the stabilization forceps to perform bimanual phacoemulsification. Irrigation of adrenaline in to the anterior chamber results in efficient pupillary dilatation, which provides adequate exposure of the lens; this facilitates further surgical procedures (Fig. 1). The viscoelastic material used *i.e*., hydroxypropyl methylcellulose ophthalmic solution was found to be effective for creating space in the anterior chamber and protecting the corneal endothelium from thermal injury. Trypan blue dye was found to be effective for differential visualization of the anterior capsular bag of the cataractous lens. The 23 G bent tip hypodermic needle used for performing capsulorrhexis was found to be satisfactory (Fig. 2). The hydro dissection done by using Ringer's lactate was found to be adequate for separating the lens from its capsule. CTR was placed inside the capsular bag by using CTR injector (Fig. 3), after filling the capsular bag adequately with viscoelastic material was found to be perfectly fitted inside the bag (Fig. 4).

The phacoemulsification unit used in the present study was found to be satisfactory for emulsifying and aspirating the lens, as well as for irrigating the anterior chamber. The hydrophobic acrylic foldable IOL used was found to be an appropriate size and was inserted comfortably in to posterior capsular bag through an average of 3.8 mm limbal incision for all the dogs.

The polyglactin 910 No. 6/0 suture material used was found to be adequate in suturing the incision with a good knot security. Injection of 5 mg Prednisolone and 5 mg Gentamicin subconjunctively immediately after the surgery was found to be adequate to prevent post-operative local inflammation and infection (Fig. 5).

2.5 Post-operative care

Systemic antibiotic, administered Amoxycillin and Clavulanic acid @ 20 mg/kg BW b.i.d for 7 days and prednisolone dispersible tablets @ 0.5mg/kg BW b.i.d for 2 weeks, followed by 0.5mg/kg BW s.i.d for next 1 week and 0.25 mg/kg BW s.i.d orally for another week. Post-operatively, advised instillation of Ofloxacin ophthalmic solution, Flurbiprofen sodium ophthalmic solution and Prednisolone acetate ophthalmic suspension @ 3 drops hourly for the 1st week followed by two hours' interval for 2nd week, 3 hours' interval for the 3rd week and 4 hours' interval for the 4th week. Application of sodium chloride ophthalmic ointment 6% w/w b.i.d for 4 weeks and instillation of operated eye twice daily for 4 weeks. Application of Elizabethan collar of suitable size in all the cases for 21 days was advised to prevent self-mutilation.

2.6 Capsular tension ring

Capsular tension ring (PMMA CTR Ring*, PMMA Single Piece Capsular Tension Ring with Two Eyelets, Model: TCR 1311, Normal size: 13.00 mm and compressed size: 11.00 mm; Model: TCR 1210, Normal size: 12.00 mm and compressed size: 10.00 mm, Truviz Ophthalmic, Dharmapuri – 636 706, Tamilnadu, India) inside the capsular bag. The CTR has a compressible open-ring circular shape made of PMMA material with a square cross-section and sharp-edge design. Angled rounded eyelets on either end of the open-ring facilitate easy manipulation for safe implantation (Fig. 6).

Appropriate CTR injector (Tension ring injector, Wipak medical, Madhu instruments Pvt. Ltd, New Delhi – 110 020, India), was also designed to advance the CTR inside the capsular bag without any difficulty. The CTR injector serves to prevent CTR contact from contaminated extra ocular surfaces inside the capsular bag. The injector contains a hook designed to engage the CTR eyelet, which then draws it back

into the injector upon release of the plunger. The plunger was depressed to extrude the CTR into the equatorial aspect of the capsular bag.

2.7 Hydrophobic aspheric 360° square edge foldable IOL

The hydrophobic aspheric 360° square edge foldable IOL (Truviz Phobic*, Model: THF 613, Power: +41.00 D, Optic Size: 6.00 mm, Overall Size: 13.00 mm, Truviz Ophthalmic, Dharmapuri - 636 706, Tamilnadu, India) with cartridge and soft tipped injector was used in the present study (Fig. 7).

3. Results and Discussion

The cataractous eye was fixed by placing stay sutures in the bulbar conjunctiva using polyamide No. 0 was adequate for positioning and fixing the eye for surgery; is in agreement with Kopala (2008) [10] and Suresh (2018) [11].

A double bevel keratome blade 2.8 mm size was found to be adequate for performing a limbal incision at 10 O'clock position in precise to enter the anterior chamber (Nelms *et al.*, 1994 [12] and Ramani *et al.*, 2011 [13]). A 20 G MVR blade was found to be adequate in making a side port at 2 O'clock position, for performing a modified bimanual phacoemulsification technique; in which one hand controls the phacoemulsification hand piece and the other holds the stabilization forceps as followed by Ali *et al*. (2007) [14] and Raghuvanshi and Maiti (2013) [15].

The anterior chamber was entered through a limbal incision, an incision at the limbus has the advantage of lesser astigmatism, as indicated by Nelms *et al.* (1994) [12], Ramani *et al.* (2011) [13] and Suresh (2018) [11], whereas Joy *et al.* (2011) [16] stated when comparing limbal against corneal incision, limbal incision increased the incidence of iris bulging. In the present study, limbal incision was found to be adequate for entering the anterior chamber without changing the iris characteristics.

Irrigation of one ml adrenaline into the anterior chamber results in efficient pupillary dilatation for adequate exposure of the lens. Similar findings were also observed by Ramani *et al.* (2011) [13] and Suresh (2018) [11].

Viscoelastic material, *i.e*., hydroxypropyl methylcellulose ophthalmic solution was found to be adequate for maintaining the stability and integrity of the anterior chamber, coated and protected the corneal endothelium, intraocular tissues and is in agreement with Glover and Constantinescu (1997) [17], Kopala (2008) [10] and Ramani *et al.* (2011) [13]. A 23 G hypodermic needle bent at the tip at an angle of 45º was found to be satisfactory for carrying out curvilinear capsulorrhexis to open the anterior capsule of the lens, was also followed by Olesan *et al.* (1980) [18], Ramani *et al*. (2011) [13] and Suresh (2018) [11].

The CTR is a specially designed ring that was developed by Nishi and coauthors in 1998. Made of poly methyl methacrylate (PMMA) material, the CTR is an open band-shaped ring that measures 0.2 mm in thickness, 0.7 mm in width and 11.0 mm in diameter with pretension and 13.0 mm in diameter when open (Nishi *et al*., 1998) [19].It has blunt tipped eyelets at both ends and was designed to be implanted permanently into the capsular bag (Bayraktar *et al*., 2001) [20]. CTR is square cross-section, sharp-edged in design and might mechanically compress the capsule, reduce the distance between IOL and capsular bag. Thus inhibits the lens epithelial cells (LECs) migration and reduce the development of PCO, as opined by Menapace *et al*. (2008) [21] and Wilkie *et al.* (2014) [22]. The CTR was placed inside the capsular bag after filling the capsular bag with adequate viscoelastic material. Then the CTR was inserted with the help of CTR injector but before phacoemulsification. Similar procedure was also carried out by Jacob *et al.* (2003) [23] and Ma and Li (2014) [24]. In contrast to this, Praveen *et al*. (2003) [25] and Ahmed *et al*. (2005) [26] implanted CTR after cortical aspiration and before IOL implantation. In our study, placement of CTR was done before phacoemulsification made placement of the CTR easier and produce less capture of lens and cortex material between the bag and the ring and there were no major complications encountered. All eyes of the group have an intact capsular bag and the findings are in agreement with Hasanee and Ahmed (2006) [27]. In this study, placement of CTR inside the capsular bag stabilized the bag contour and which helped for performing phacoemulsification as well as perfect IOL implantation (Jacob *et al.*, 2003) [23]. CTR was placed in our study in such a way that both the eyelets just overlapped each other as opined by Goldman and Karp (2007) [28].

Phacoemulsification performed was found to be satisfactory for emulsifying and aspirating the cataractous lens material (Cook, 2008[29] and Ramani *et al*., 2011[13]). The technique used in this study was bimanual phacoemulsification or two-handed technique, was found to be adequate as all cases in the present study were of mature cataracts. The principle advantage is a greater flexibility in lens manipulation afforded by having two instruments in the eye. This technique results in quicker and safer surgery because the lens can be cracked, without the need for sculpting near the posterior capsule and the lens can be fed to the phaco tip. A major disadvantage of this technique is that it is technically more demanding, because two separate instruments are in the eye, this is in agreement with Glover and Constanstinescu (1997) [17] and Suresh (2018) [11].

Hydrophobic foldable acrylic IOL, +41D was used and found to be satisfactory for the study. In the present study, 66.67% of the dogs regained vision by the end of observation period is in agreement with Ofri (2008) [30] and Raghuvanshi and Maiti (2013) [15]. The lens material used was acrylic, which has a lower incidence of posterior capsular opacity as compared to other lens materials, is in agreement with Yi *et al.* (2006) [31] and Raghuvanshi and Maiti (2013) [15]. It is foldable synthetic lens, hence it could be injected through a smaller rent less than 3 mm, it results in minimal or no induced astigmatism, smaller scar accompanied by greater corneal transparency, provides much more rapid visual and physical recovery, prompt refractive stability and promote better coaptation of the surgical incision (Pandey *et al*. 2004 [32] and Honsho *et al*., 2007 [33]). The +41 D power used for the present study was found to be adequate for restoring the vision to dogs. Similar findings were also reported by Gaiddon *et al*. (1991) [34] and Yi *et al.* (2006) [31]. However, Hayashi and Hayashi (2005) [35] reported an acrylic optic IOL had significantly lower PCO than a PMMA optic IOL. According to Hollick *et al.* (1999) [36], there was a significant difference in percentage of PCO among the lens types; polyacrylic lenses were associated with less PCO (10%) than silicone (40%) and PMMA lenses (56%).

Follow-up was carried out on 1st, 3rd, 7th, 14th, 21st, 30th, 60th, 90th, 120th, 150th, 180th and 210th day post-surgery. Complications encountered postphacoemulsification includes corneal opacity, episcleral congestion, PCO, hyphaema, glaucoma, aqueous flare, fibrin deposits and posterior synechiae (Table 1).

3.1 Complications observed on naked eye examination

3.1.1 Hyphaema (Fig. 8)

Hyphaema was observed on 0th day after surgery in cases No. 1, 2, 5 and 6 except in cases No. 3 and 4, was resolved completely by 3rd post-operative day in cases No. 1, 5 and 6, by 30th day in case No.2. This could be due to accidental injury to the iris during phacoemulsification or IOL haptic causing damage to iris, uveitis and retinal detachment or due to patient causing trauma to the eye as reported by Klein *et al*. (2011) [37]. Hyphaema was resolved completely in all cases after topical corticosteroid therapy.

Fig 1: Infusion of Adrenaline

Fig 2: Capsulorrhexis

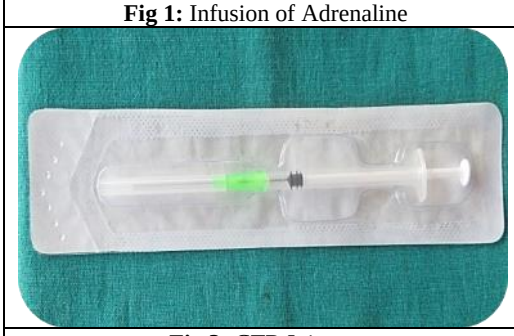

Fig 3: CTR Injector

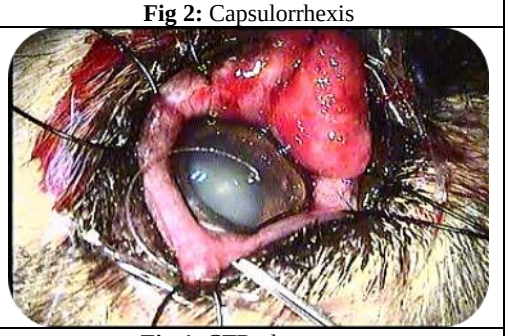

Fig 4: CTR placement

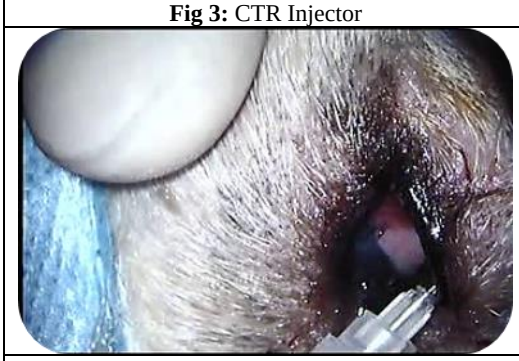

Fig 5: Subconjunctival injection

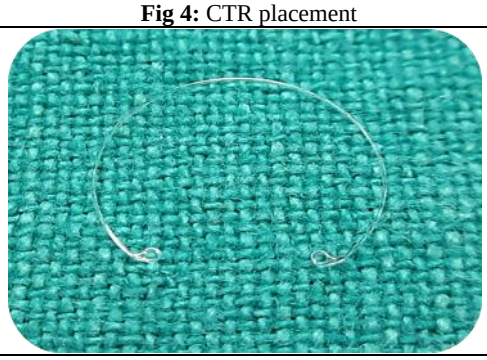

Fig 6: Capsular Tension Ring(CTR)

Fig 7: Hydrophobic aspheric foldable IOL used in the study

Hyphaema was observed more because of longer manipulation, it results in uveal damage might be the reason while placement of CTR inside the lens capsule. The findings are in concurrence with the reports of Morales *et al*. (2015) [38].

3.1.2 Chemosis (Fig. 9)

Chemosis was observed immediately after the surgery on 0th day in all cases. However, in cases No. 1 and 2, chemosis was extended up to 7th post-operative day, in case No. 4 it extended up to 14th day, while in cases No. 3 and 5 it was extended up to 3rdpost-operative day, while in case No. 6, it was resolved completely on 1st post-operative day. These findings are in agreement with Morales *et al.* (2015) [38].

3.1.3 Corneal opacity (Fig. 10)

Corneal opacity was observed on 3rd post-operative day itself in cases No. 1, 2, 3 and 6, on 21st day in cases No. 4 and 5, it was resolved completely by 60th post-operative day in cases No. 5 and 6, by 150th day in cases No. 1 and 4, by 210th day in

case No. 3, while the corneal opacity persists till the end of study period in case No. 2.

Development of corneal opacity might be due to the high heat energy production lead to damage to the corneal endothelium or excessive handling, as the cases selected was mature cataracts, which require a longer duration for phacoemulsification. This is in agreement with Dziezyc (1990) [39] and Joy *et al*. (2011) [16].

3.1.4 Episcleral congestion (Fig. 11)

All the cases have developed episcleral congestion on 3rd post-operative day, it was resolved completely by 7th post-operative day in case No. 6, by 30th day in case No. 3, by 60th day in cases No. 1, 4 and 5, while it completely resolved by 150th post-operative day in case No. 2. The appearance of episcleral congestion in all dogs could be due to implantation of CTR as well as hydrophobic acrylic IOL insertion inside the capsular bag causes more inflammatory reaction. The findings are in concurrence with the reports made by Morales *et al.* (2015) [38] and Huang *et al.* (2016) [40].

3.1.5 Posterior capsular opacification (PCO) (Table 2)

Posterior capsular opacification (PCO) was observed in one of the case (case no. 1) *i.e*., 16.67%, that too was observed nasal in position. These findings are in agreement with Yi *et al*. (2006) [31], Gift *et al*. (2009) [41] and Hara *et al*. (2011) [42]. Morales *et al*. (2015) [38] also reported PCO occurred only in 1/10 (10%) of the eyes with CTR placement and hydrophobic acrylic foldable IOL implantation group in their study. What is noteworthy in this study is the almost absence of PCO formation in all the dogs, even after 7 months' post-surgery. Implantation of CTR inside the capsular bag significantly decreases the PCO, but it could unable to prevent it completely. These findings are in accordance with Halili *et al.* (2014) [43]. Gift *et al*. (2009) [41] reported mean ± SE PCO scores for the PMMA, hydrophilic acrylic lens and hydrophobic acrylic lens were 0.85 ± 0.073, 0.54 ± 0.088 and 0.64 ± 0.098, respectively.

It is also believed that sharp-edged IOLs and CTRs can produce a "barrier effect" preventing the migration of these cells and consequently, the PCO formation (Apple *et al*., 2001) [44].

Iris-derived pigment cells on the posterior capsule, proliferation and migration of residual LECs, fibroblasts and macrophages are considered as the causative factors for PCO formation (Kappelhof and Vrensen, 1992) [45]. These residual LECs differentiate into fibroblast-like cells via epithelial mesenchymal transformation (EMT), resulting in fibrous plaque formation. Few authors believed that the re-colonization of the anterior LECs over the anterior capsule and then migrate to the posterior lens capsule (Wormstone, 2002) [46]; while others believed that, the primary source for PCO formation are the equatorial LECs (Apple *et al*., 2001) [44]. The reduction in visual acuity in PCO could be attributed to epithelial mesenchymal transformation (EMT) of LECs from normal cuboidal epithelial cells in to myofibroblastic-like cells and can migrate along the posterior face of the lens capsule to produce significant opacification and reduction of the vision (Gift *et al.*, 2009) [41]. Small and medium sized breeds develop significantly more PCO in comparison to large breeds.

3.1.6 Glaucoma (Fig. 12)

Cases No. 3 and 4 developed glaucoma on 14th and 30th post-operative day, respectively, it was regressed by 180th post-operative day in case No. 4 but in case No. 3 did not resolve even at the end of observation period. Sigle and Nasisse (2002) [47] reported glaucoma after cataract surgery might often occurs in some breeds, such as Shish Tzu, Cocker Spaniel and Boston terrier.

However, incidence of glaucoma to the tune of 6.7% and 38.2% for cataract surgery in dogs was reported by Klein *et al.* (2011) [37] and Lim *et al.* (2011) [48], respectively.

3.1.7 Aqueous flare

Aqueous flare was observed in two animals on 3rd post-operative day in case No. 2 and on 30th post-operative day in case No. 3, it resolved completely by 21st day in case No. 2 and by 90th post-operative day in case No. 3, respectively. This could be due to IOL implantation lead to breakdown of blood aqueous barrier (BAB) (Abela-formanek *et al*., 2002) [49].

3.1.8 Fibrin deposits

Post-operative fibrin deposits were observed in case No. 2, on 14th post-operative day and regressed completely by 21st post-operative day. Fibrin deposits were seen as sequelae to aqueous flare reported by Nitin (2013) [50].

3.1.9 Posteriorsynechiae (Fig. 13)

Posterior synechiae was noticed in cases No. 2 and 5 on 21st post-operative day, it did not resolve until the end of study period. However, Morales *et al*. (2015) [38] recorded synechiae on 14th post-operative day and it had increasing tendency during the observation period in their study. Tuntivanich and Tuntivanich (2007) [51] reported that intraoperative miosis, hyphaema and post-operative fibrin deposition, uveitis and glaucoma were causative factors for posterior synechiae. Nitin (2013) [50] also made similar opinion

4. Conclusion

Placement of CTR reduces the PCO to some extent but it could not arrest completely. Its use also associated with few minor complications like uveitis, episcleral congestion, posterior synechiae etc; due to these, the benefit of CTR devices in dogs should be evaluated. However, in the present study, it was possible to admit that the use of CTR can play an important role in the prevention of PCO, without major complications. Although in the present study, the period of evaluation stopped at the 210th post-operative day and more PCO can be formed during the following months or years after the surgery, it is a critical period for PCO to begin. The results of this study are promising. However, a long-term follow-up will be needed because PCO may develop several years after the cataract surgery.

Table 1: Gross changes in the eyes prior and post-surgery in the dogs

Case No.	Day 0 (Before Surgery)	Day 0 (After Surgery)	Day 1	Day 3	Day 7	Day 14	Day 21	Day 30	Day 60	Day 90	Day 120	Day 150	Day 180	Day 210
1	-	Bl^{++}, C^{++}, P^{++++}	Bl^{++}, C^{++}, P^{++}, OD^{++}, H^{+++}, CO^{+++}	CP^{++}, P^{+}, OD^{+++}, H^{+++}, CO^{++}, E^{+}	C^{+}, OD^{+++}, CP^{+}	OD^{+++}, CP^{++}	E^{++}, CP^{++}	E^{++}, CP^{+++}	E^{+}, CP^{++}	CP^{++}	CP^{++}	-	PCO^{+}	PCO^{+}
2	-	Bl^{++}, C^{+++}, P^{+++}	Bl^{++}, C^{++}, P^{++}, OD^{++}, H^{+}, CO^{++}	C^{+}, E^{+}, P^{+}, OD^{+}, H^{+}, CO^{+}, Af^{+}, CP^{+}	C^{+}, E^{+}, H^{+}, CO^{+}, Af^{+}, CP^{+}	E^{+}, CP^{++}, H^{+}, Af^{+}	E^{++}, CP^{+++}, H^{+}, PS^{+}	CP^{+++}, E^{+++}, H^{+}, PS^{+}	CP^{+++}, PS^{+}, E^{++}	CP^{++}, PS^{+}, E^{+}	CP^{++}, E^{+} PS^{+}	CP^{++}, E^{+}, PS^{+}	CP^{+}, PS^{+}	CP^{+}, PS^{+}
3	-	Bl^{+}, C^{++}, P^{++}	Bl^{+}, C^{++}, CO^{++}, OD^{+}, P^{+}	C^{+}, E^{+}, CO^{+}, OD^{+}, CP^{+}, Bl^{+}, P^{+}	Bl^{+}, P^{+}, OD^{+}, CP^{++}, E^{+}	CP^{+++}, E^{+}, G^{++}	CP^{+++}, E^{+}, G^{++}	CP^{++}, E^{+}, Af^{+}, G^{++}	CP^{++}, Af^{+}, G^{++}	CP^{+}, G^{++}	CP^{+}, G^{++}	CP^{+}, G^{++}	CP^{+}, G^{++}	G^{++}
4	-	Bl^{++}, C^{++}, P^{++}	Bl^{+}, C^{++}, P^{+}, CO^{++}, OD^{++}	CO^{+}, OD^{++}, E^{+}, C^{++}	CO^{+}, OD^{++}, C^{++}, E^{+}	C^{+}, E^{+}	CP^{+}, E^{+}	CP^{+++}, E^{++}, G^{+}	CP^{+++}, E^{+}, G^{+}	CP^{++}, G^{+}	CP^{+}, G^{+}	G^{+}	-	-
5	-	Bl^{++}, C^{+}, P^{+}	Bl^{+}, C^{+}, P^{+}, CO^{+}, OD^{+++}, H^{+++}, E^{+++}	C^{+}, CO^{+}, OD^{++}, H^{++}, E^{++}	CO^{+}, OD^{+}, E^{+}	OD^{+}, E^{+}	CP^{+}, OD^{++}, E^{++}, PS^{+}	OD^{+}, E^{+}, PS^{+}	E^{+}, PS^{+}	PS^{+}	PS^{+}	PS^{+}	PS^{+}	PS^{+}
6	-	Bl^{+}, C^{+}, P^{+++}	Bl^{+}, C^{+++}, P^{+}, CP^{+}, OD^{+++}, CO^{++}, H^{++}	E^{++}, CP^{+}, OD^{+}, H^{+}, P^{+}	CP^{+}, E^{+}	CP^{+}	CP^{+}	CP^{+}	-	-	-	-	-	-

Bl - Blepharospasm; C-Chemosis; CP - Corneal opacity; CO - Corneal Oedema; E - Episcleral congestion; OD - Ocular Discharge; PCO - Posterior Capsular Opacity; P - Photophobia; H - Hyphaema; PS - Posterior Synechia; Af - Aqueousflare;G - Glaucoma
+ Mild; ++ Moderate; +++ Severe; ++++ Extensive; - Nil

Table 2: Development of Posterior Capsular Opacification (PCO), its position and Fundus Visibility during different Observation time period in the dogs of both the groups

Case No.	Day 0 (Before)	Day 0 (After)	Day 1	Day 3	Day 7	Day 14	Day 21	Day 30	Day 60	Day 90	Day 120	Day 150	Day 180	Day 210
1	-	-	-	-	-	-	-	-	-	-	-	-	**PCO^{+} (Grade I) (N)**	**PCO^{+} (Grade I) (N)**
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-

+ Mild (Grade I); ++ Moderate (Grade II); +++ Severe (Grade III); - Nil
- Nil: Visibility of Fundus was very clear with clearcut appearance of optic nerve head, blood vessels, tapetal part and non-tapetal part
Grade I PCO: Visibility of Fundus was clear with mild blurred appearance of optic nerve head, blood vessels, tapetal part and non-tapetal part
Grade II PCO: Visibility of Fundus was not clear with moderate blurred appearance of optic nerve head, retinal vessels, tapetal part and non-tapetal part
Grade III PCO: Visibility of Fundus was not clear with lack of appearance of margins of optic nerve head, hazy appearance of retinal vessels, tapetal part and non-tapetal part N - Nasal; C - Central; T – Temporal

Post-operative complications observed in the dogs

Fig 8: Hyphaema

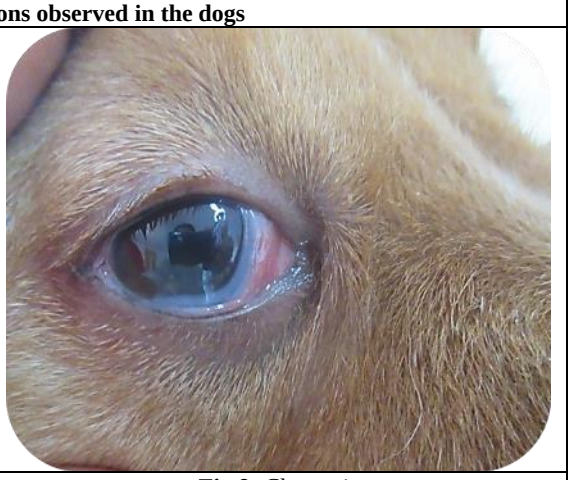

Fig 9: Chemosis

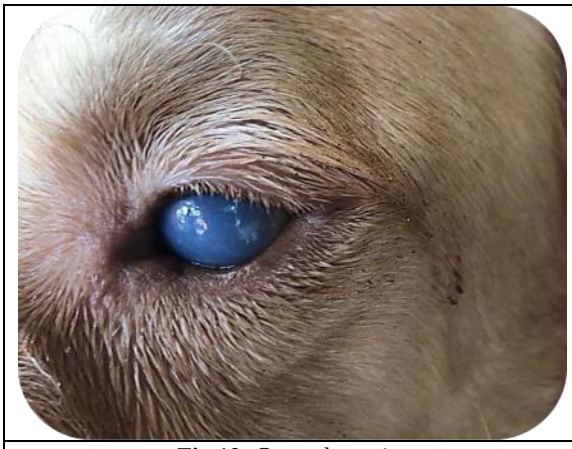

Fig 10: Corneal opacity

Fig 11: Episcleral congestion

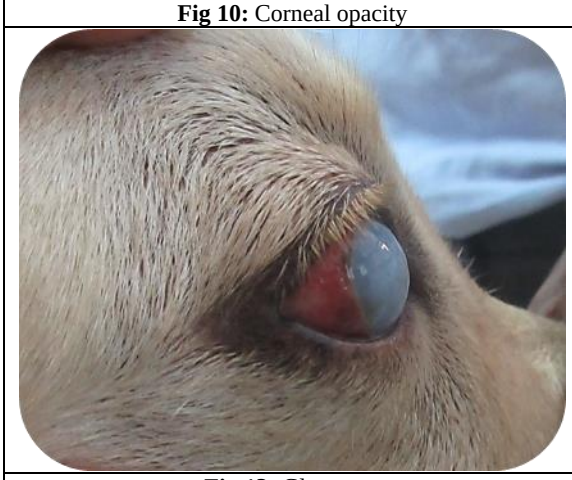

Fig 12: Glaucoma

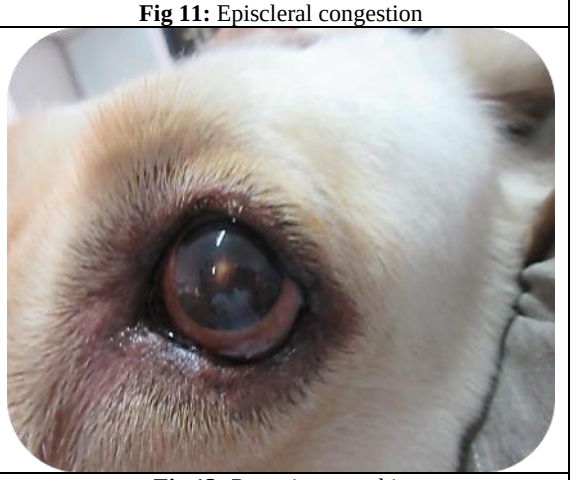

Fig 13: Posterior synechia

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