EFFECT OF N-BUTYL-CYANOACRYLATE TISSUE ADHESIVE ON CANINE CORNEAL ULCERS

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Abstract

The study was conducted in six dogs with corneal ulcer of varying degree presented to University Veterinary Hospital, Kokkalai and Mannuthy. All dogs had undergone, complete clinical haematological and biochemical examination. Detailed ophthalmic examination was carried out to assess type and extent of corneal ulcer and integrity of cornea. All dogs were advised topical antibiotic as initial treatment modality. Five days later corneal ulcer was sealed with N-butyl-cyanoacrylate tissue adhesive under general anaesthesia and additional support by temporary tarsorrhaphy. Post-operatively all dogs were on Elizabethan collar and continued with topical instillation of antibiotic for few more days. Cornea was graded further for clarity, vascularization, oedema and pigmentation on day 5, 15 and 30. The application of N-butyl-cyanoacrylate was effective for the treatment of corneal ulcers and the dogs regained visual function with improved clarity and minimal complications.

Key words: *N-butyl-cyanoacrylate, corneal ulcer, dogs, corneal clarity.*

The importance of cyanoacrylate tissue adhesive as a tool for non-suture closure of wounds in soft tissue and bone has been increased in current day practice in both human and veterinary medicine. Cyanoacrylates are the esters of cyanoacrylic acid with an alkyl side chain, these monomers solidify by anionic polymerization when coming in contact with a weak base at room temperature liberating minimal amount of heat and forms a strong bond with the connective tissue, that too with least toxicity. In the field of ophthalmology, cyanoacrylate is mainly used as a corneal patch in sealing corneal perforation. In the treatment of corneal ulcer, cyanoacrylate tissue adhesive is found to inhibit progressive stromal melting, provides tectonic support to denuded corneal epithelium and possess anti-bacterial activity. It can be applied directly or glued on the contact lens in case of severe corneal damage (Watte *et al*., 2004) The present

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study was conducted to evaluate the efficacy of N-butyl-cyanoacrylate tissue adhesive as a protective shielding in management of corneal ulcerations in dogs.

Materials and methods

Six dogs which were presented at University Veterinary Hospital, Kokkalai and Mannuthy, with corneal ulcer were selected in the study. Preliminary clinical and haematological examination was performed. Detailed ophthalmic examination, which included observations under direct illumination, Schirmer tear test, fluorescein dye test to check the integrity of cornea and measurement of intraocular pressure assessed by using tono-pen in each case were conducted. Animals were under initial topical antibiotic therapy with moxifloxacin thrice a day for five days. Animals were presented after 12 h of fasting for surgery. General anaesthesia was induced using intramuscular administration of ketamine hydrochloride @ 5 mg/kg body weight under premedication with intramuscular administration of atropine sulphate @0.045mg/kg body weight and xylazine hydrochloride @ 0 1.5 mg/kg body weight. Animals were placed in lateral recumbence with the affected eye facing upwards. The corneal surface was prepared for aseptic surgery by repeated instillation of normal saline and povidone iodine 1:50 solution alternately for six times. A small wired eye speculum was applied to completely visualize the cornea. After through debridement of the ulcer bed with sterile cotton bud, bovine collagen gel impregnated with 0.1 per cent gentamicin was applied over the ulcer. N-butyl-cyanoacrylate tissue adhesive was applied in the dried ulcer bed for effective polymerization with corneal tissue. Care was taken to prevent overspreading of the glue and accidental adhesion of tissue adhesive to eyelids and nictitating membrane. Temporary tarsorrhaphy suture was applied with silk 1/0. Elizabethan collar was applied to prevent self-mutilation. Sutures were removed on day five post treatment. All dogs continued on topical antibiotic therapy with moxifloxacin for 10 more days post-operatively.

Cornea was examined and graded on day of presentation, the day of surgery, day five, 15 and 30 post treatment. Grading was done as follows: Corrneal clarity - (1+ completely opaque, 2+ moderately opaque, 3+ hazy and 4+ clear); Corneal vascularization - (0- no vascularization, 1- mild superficial vascularization, 2- profuse superficial vascularization and 3- intense vascularization). For grading pigmentation, cornea was schematically divided into 24 segments, with 12 segments each on central and peripheral circles (Azoulay, 2013). Each sector was evaluated for the presence, extent and density of pigmentation. Corneal pigmentation density was graded with in sectors from 0 to 3 (0- none, 1- fundus visible, 2- iris visible, 3- cornea opaque). Pigmentation density of a particular cornea was calculated by adding all the sectors grades (maximum grade for a totally pigmented cornea was 72). Extent was calculated by adding all the affected sectors out of total 24 sectors. Mean pigmentation density was calculated by dividing pigmentation grading with extent of pigmentation. Similar method was followed for grading corneal oedema.

Results and discussion

In the present study, out of six dogs selected the age of the affected dogs ranged from six to 144 months (Table:1). The six corneal ulcers included two deep stromal ulcers,

Table 1: Signalment and anamnesis of the selected cases

Sl. No.	Breed	Sex	Age (months)	Eye affected	Type of corneal ulcer
1	Chinese pug	M	6	Right	Deep stromal
2	Chinese pug	F	24	Left	Descemetocele
3	Chinese pug	M	8	Left	Superficial ulcer
4	Chinese pug	F	12	Left	Superficial ulcer
5	Lhasa apso	F	144	Left	Superficial ulcer
6	Chinese pug	F	21	Left	Deep stromal

descemetocele and three superficial ulcers. Animals were presented with clinical signs such as increased lacrimation, ocular pain, blepharospasm, corneal oedema and corneal vascularization on the day of presentation (Fig. 1) as previously reported by Andrade *et al*. (1999). In all the cases cornea was sealed with N-butyl-cyanoacrylate tissue adhesive. Of the affected dogs two were male and four were female. All the dogs affected with corneal ulcer in the study were Chinese pugs, except for one Lhasa apso.

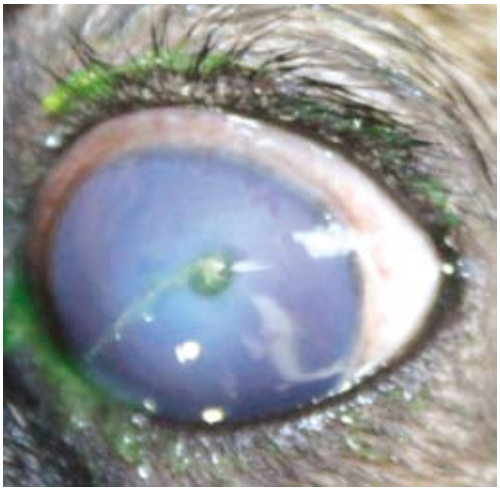

Fig. 1. Case 6, on day of presentation

Occurrence of traumatic corneal ulcer was higher in dogs aged within three years, which might be due to increase in activity observed in dogs of early to middle aged groups (Kim *et al*., 2009). Pugs were the breed frequently predisposed to corneal ulcer due to its brachycephalic character owing to inadequate corneal protection (Gelatt, 2009).

Adverse reactions were not noted in five cases on the day of first review, day five. However, slight vascularization changes (Table: 2) were observed in one case on day five (Fig. 2) which gradually reduced later on as documented by Kadambari *et al*. (2014). Watte *et al*. (2004), described vascularization as a reaction caused by cyanoacrylate ocular tissue. Schirmer tear test values showed slight increase on day five and 15, due to the increased lacrimation which may be due to mild ocular discomfort caused by the tissue glue (Watte *et al*., 2004). Intra-ocular pressure

Fig. 3. Case 6, day 30 post treatment

remained within normal range without any significant changes in all the animals.

Corneal clarity (Table 2) on day of presentation in case 1, was opaque due to oedema and later on subsided by day of surgery and cornea on day 15 and 30 became opaque due to formation of corneal vascularization and pigmentation as previously reported by Gosling *et al*. (2013). In the other four cases cornea was hazy on day of presentation due slight corneal oedema and ulcer and on day five due to presence of central scar cornea appeared opaque which was subsided later on as was observed by Watte *et al*. (2004). In the remaining one case corneal pigmentation and vascularization was noted at the medial aspect on the day of presentation, with mild corneal oedema affecting the corneal clarity very lightly. After treatment on day five moderate vascularization reaction was noticed. Further on day 15 and 30, mild scarring was noticed without affecting visual function.

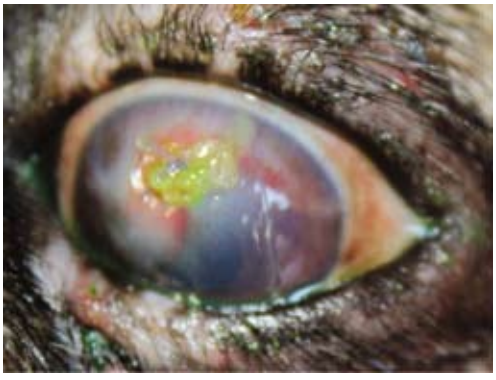

Fig. 2. Corneal vascularization caused due to N-butyl-cyanoacrylate

Table 2: Corneal grading for corneal clarity and vascularization

Sl. No	CORNEAL CLARITY					CORNEAL VASCULARIZATION				
	DP	DS	D 5	D 15	D 30	DP	DS	D 5	D 15	D 30
1	1+	2+	3+	2+	1+	0	0	0	1	0
2	3+	3+	2+	3+	3+	3	3	3	3	0
3	3+	3+	3+	3+	3+	0	0	0	0	0
4	3+	3+	4+	3+	3+	0	0	0	0	0
5	3+	3+	3+	3+	4+	0	0	0	0	0
6	1+	3+	3+	3+	4+	0	0	0	0	0

Corneal pigmentation was developed in one case as a process of corneal healing, with decrease in mean pigmentation by the end of observation, not affecting the visual function. Whereas in another case, pigmentation was present from the day of presentation onwards (Table 3). Signs of corneal pigmentation were not observed in the remaining cases.

Corneal oedema was observed on the day of presentation in three cases which decreased after initial topical antibiotic therapy (Table 4).

By the end of the study all animals regained visual function, with improved clarity and without any complications (Fig. 3). Hence, it is concluded that sealing with N-butyl-cyanoacrylate tissue adhesive was an effective treatment modality in canine corneal ulcers for restoration of corneal function with minimal adverse reaction .

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