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CASE REPORT
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Corneal Ulcers in a Cat - Treatment with n-butyl-2-cyanoacrylate Adhesive

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ABSTRACT

***Background*:** When left untreated, corneal ulcers can progress unfavorably, posing a risk to the vision of an animal. The application of cyanoacrylate adhesive offers an alternative for treating deep ulcers without the need for surgical intervention that requires using sutures on the cornea. This adhesive not only has antibacterial properties but also demonstrates antifungal efficacy. Moreover, it is easily accessible and cost-effective, making it a promising solution. The objective is to report a case of deep corneal ulcers in a cat successfully treated with n-butyl-2-cyanoacrylate adhesive.

***Case*:** A 4-month-old male Persian cat had been experiencing ocular discomfort and tearing for 7 days. There was no reported history of previous ocular trauma, and no treatment had been administered. Examination of the right eye revealed severe blepharospasm, photophobia, epiphora, conjunctival hyperaemia, chemosis, miosis and mucopurulent ocular discharge. Pupillary light reflexes, including direct, consensual and dazzle reflexes, were tested with a light source and were within normal limits, with preserved vision. No abnormalities were observed in the left eye. Using a portable slit lamp, five deep stromal corneal ulcers were observed in the right eye, along with mild diffuse corneal edema. Fluorescein staining was performed, and the dye impregnated all corneal ulcers. All ulcers were less than 3 mm in diameter. During the same consultation, the application of n-butyl-2-cyanoacrylate adhesive (Hystoacryl®) at the lesion sites and covering with the third eyelid were indicated. The epithelium near the lesions was debrided with a scalpel blade, and the lesion sites were dried with cellulose sponges before applying cyanoacrylate adhesive using an insulin syringe and needle. All corneal ulcers were covered with the adhesive. After 1 min, the adhesive was polymerised using Ringer's lactate solution applied with a 3 mL syringe. Tobramycin 0.3% eye drops [every 4 h for 15 days] and sodium flurbiprofen-based eye drops [every 4 h for 15 days] were prescribed. In addition, 1% atropine sulphate ophthalmic ointment was prescribed [SID for 5 days]. To prevent self-trauma, the use of an Elizabethan collar was recommended for 15 days. Weekly evaluations were conducted. Twenty-one days after the procedure, intense corneal opacity and granulation tissue were observed at the lesion sites. The fluorescein staining test was negative. Thirty days after the procedure, remission of granulation tissue and decreased corneal neovascularization were observed, and finally, after 6 months, only mild opacity was present in the area where the adhesive had been applied, and the remaining cornea stayed transparent. The patient had visual function.

***Discussion*:** The advantages of cyanoacrylate adhesives include short surgical time, bacteriostatic activity against gram-positive bacteria, inhibition of inflammatory cell migration and collagenase formation, low cost, easy and rapid polymerization and the absence of the need for sutures. Despite the widespread use of cyanoacrylate adhesive in human ophthalmology, its application in animals is still limited, with few documented and reported clinical cases. Compared to other methods employed for the surgical treatment of corneal ulcers, cyanoacrylate adhesive offers several advantages, such as easy and quick application and not requiring sutures in the cornea. In this case, all the ulcers were up to 3 mm in diameter each, and the treatment of them was successful. Besides maintaining the integrity of the eyeball, the adhesive served as a support for healing. The patient maintained visual function with a transparent cornea.

Keywords: cat, ophthalmology, cyanoacrylate adhesive.

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INTRODUCTION

Corneal ulcers can progress unfavorably to ocular perforation. Due to the risk of vision loss, they require emergency care, and if left untreated, complications such as glaucoma, endophthalmitis and subsequent vision loss may occur [2]. Several surgical procedures have been used for the treatment of deep corneal ulcers, including conjunctival grafts, amniotic membrane, corneal transplantation and fibrin glue [12,14,21]. Cyanoacrylate adhesives can be used in corneal thinning and in ocular perforations smaller than 3 mm in diameter [6]. In humans, cyanoacrylate adhesive has been used to treat small partial corneal lacerations, descemetoceles, deep stromal corneal ulcers and perforations, with excellent results [2,6,18,21]. Cyanoacrylate adhesive has antibacterial properties [9], and its use is an easily accessible and cost-effective alternative compared to other surgical procedures [14,19]. One study demonstrated the antifungal effects of n-butyl-2-cyanoacrylate against a variety of fungal species [5]. During polymerization and degradation, cyanoacrylate adhesives release toxic compounds such as cyanoacetate and formaldehyde, which makes their use contraindicated in extensive corneal injuries due to potential tissue toxicity [6,11]. Short-chain ethers are considered toxic as they rapidly degrade rapidly into cyanoacetate and formaldehyde, leading to tissue inflammation. As the number of carbons increases, the adhesive is considered more biocompatible [10]. In animals, its use is still limited, and few clinical cases are available in the literature [1,13,20]. This report describes a case of deep corneal ulcers in a cat treated with n-butyl-2-cyanoacrylate adhesive.

CASE

A 4-month-old male Persian cat with ocular discomfort was referred to the Veterinary Ophthalmology Service at the Federal University of Rio Grande do Sul. According to the anamnesis, the patient had been experiencing ocular discomfort and tearing for 7 days. There was no reported history of previous ocular trauma, and no treatment had been administered.

Upon general physical examination, no alterations in physiological parameters were observed. Anaesthetic eye drops[1] [containing 10% tetracaine hydrochloride and 0.1% phenylephrine] were instilled prior to ophthalmic examination. Examination of the right eye revealed severe blepharospasm, photophobia, epiphora, conjunctival hyperemia, chemosis, miosis and mucopurulent ocular discharge. Pupillary light reflexes, including direct, consensual and dazzle reflexes, were tested with a light source and were within normal limits, with preserved vision. No abnormalities were observed in the left eye. Pupillary dilation of both eyes was performed and after 20 min, using a portable slit lamp Kowa SL15[2], 5 deep stromal corneal ulcers were observed in the right eye, along with mild diffuse corneal oedema (Figure 1). Fluorescein[3] staining was performed, and the dye impregnated all corneal ulcers. All ulcers were less than 3 mm in diameter.

Figure 1. Image of the right eye globe of a feline with corneal ulcers. Five deep corneal ulcers, chemosis and corneal oedema were observed. The pupil was dilated, with topical mydriatics.

During the same consultation, the application of Histoacryl [n-butyl-2-cyanoacrylate adhesive][4] at the lesion sites and covering with the third eyelid were indicated. Tobramycin [Tobrex®[5] 0.3% eye drops - every 4 h for 15 days] and sodium flurbiprofen [Ocufen®[5] eye drops - every 4 h for 15 days] were prescribed. In addition, 1% atropine[6] sulphate ophthalmic ointment was prescribed [SID for 5 days]. The patient was referred for blood collection for hemogram and biochemical profile analysis, and all results were within normal ranges. After premedication and anaesthetic induction, the patient was maintained with inhaling anaesthesia with isoflurane. Periocular trichotomy and antiseptic preparation of the right eye were performed. The patient was placed in dorsal recumbency. After placing an adhesive sterile plastic drape, a blepharostat was applied, and the eyeball was centred. The epithelium near the lesions was debrided with a scalpel blade, and the lesion sites were dried with cellulose sponges before applying cyanoacrylate adhesive using an insulin syringe and needle. All corneal

ulcers were covered with the adhesive. After 1 min, the adhesive was polymerised using Ringer's lactate solution applied with a 3-mL syringe. Subconjunctival injection of Garamicina[7] [0.1 mL] was administered, and the 3rd eyelid was fixed to the superior bulbar conjunctiva with 2 sutures using 3 monofilament nylon. Postoperatively, Mellis vet[8] [0.02 mg/kg, orally, SID for 3 days] was prescribed. To prevent self-trauma, the use of an Elizabethan collar was recommended for 15 days. Weekly evaluations were conducted.

No complications were observed during the surgical procedure. Surgical time was 10 min, and no complications were found during the weekly evaluations. Twenty-one days after the surgical procedure, the 3rd eyelid suture was removed, and the 3rd eyelid covering was undone. On that day, intense corneal opacity and granulation tissue were observed at the lesion sites. The fluorescein staining test was negative. After 30 days of the procedure, remission of granulation tissue and decreased corneal neovascularization were observed (Figure 2). After 6 months, only mild opacity was present in the area where the adhesive had been applied, and the remaining cornea stayed transparent (Figure 3). The patient had visual function.

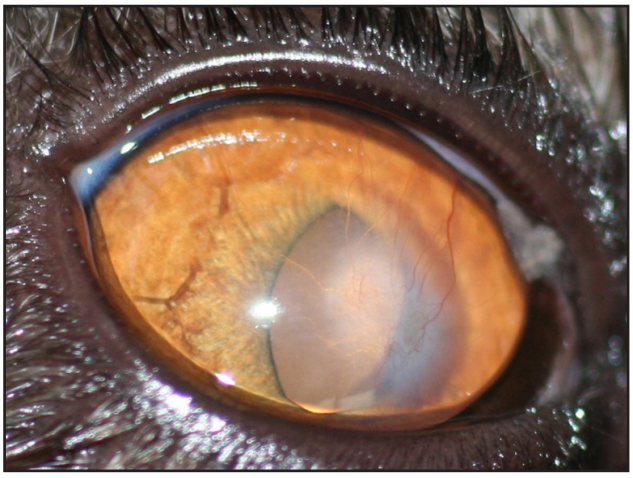

Figure 2. Image of the patient's eyeball 30 days after the use of cyanoacrylate adhesive. Opacity in the central region of the cornea and corneal neovascularization were observed.

Figure 3. Image of the patient's eyeball 6 months after the use of cyanoacrylate adhesive. Only mild opacity was observed in the region where the adhesive was applied. The remaining cornea was transparent.

DISCUSSION

Corneal ulcers can progress unfavourably to ocular perforation, which is why they need to be diagnosed and treated as quickly as possible. Among the causes of corneal ulcers are trauma, eyelid abnormalities and eyelash disorders [8]. In the reported case, the primary cause of the corneal ulcers was not identified. Generally, treatment is performed according to the classification of the corneal ulcer. The objectives of the treatment are to alleviate pain, control infection and prevent worsening of the injury and ocular perforation [8,12].

According to their depth, corneal ulcers can be classified as superficial, deep, descemetocele and corneal perforation [8]. In the presented case, the ulcers were diagnosed and classified as deep based on fluorescein staining and slit lamp examination. Fluorescein impregnation of the corneal stroma was observed in all ulcers. Deep corneal ulcers require surgical treatment, along with the use of topical eye drops [12]. Topical treatment with eye drops should include antibiotics, mydriatics and non-steroidal anti-inflammatory drugs [12]. The frequent administration of antibiotic eye drops is necessary to achieve adequate therapeutic levels and increase the healing rate in infectious keratitis. In the present report, in addition to topical antibiotic eye drops, subconjunctival injection of gentamicin was also administered.

The use of cyanoacrylate adhesive has brought significant advancement in the treatment of corneal ulcers, thinning and perforations in humans [6,7,9,11,14,17,18,21]. The advantages of cyanoacrylate

adhesives include short surgical time, bacteriostatic activity against gram-positive bacteria, inhibition of inflammatory cell migration and collagenase formation, low cost, easy and rapid polymerisation and the absence of the need for sutures [6,10,15,18]. Despite the widespread use of cyanoacrylate adhesive in human ophthalmology, its application in animals is still limited, with few documented and reported clinical cases [3,13,16].

In this case, the choice of n-butyl-2-cyanoacrylate adhesive was made due to the excellent results reported in previous studies and because the ulcers were up to 3 mm in diameter each [18]. For larger ulcers, other techniques should be chosen. Available options include biological and synthetic membranes, corneoconjunctival transposition and conjunctival flap [8,12].

Compared to other methods employed for the surgical treatment of corneal ulcers, cyanoacrylate adhesive offers several advantages, such as easy and quick application and not requiring sutures in the cornea [18]. In the present report, the surgical procedure time was 10 min, which is shorter compared to that needed for other corneal repair techniques. Additionally, when cyanoacrylate adhesive is chosen, there is no need for a second surgical procedure to remove corneal sutures. Cyanoacrylate adhesive does not require removal because it dissolves spontaneously, and the wound site is re-epithelialised.

There are several techniques described in the literature for the application of cyanoacrylate adhesive, primarily including drip application using an insulin syringe and needle, as well as the use of plastic discs [11,15,18,21]. In the present report, the drip application technique using an insulin syringe with a needle was chosen. This choice was made because it is a less time-consuming technique compared to the use of plastic discs and does not require additional materials.

Some complications during the application of cyanoacrylate adhesive on the cornea have been reported, including endothelial damage due to inadvertent injection into the anterior chamber, chemosis and symblepharon resulting from contact between the adhesive and the conjunctiva [8]. No complications were observed during the adhesive application in the present report. The use of a blepharostat to keep the eyelids open and increase exposure of the corneal lesion sites was important to prevent accidental adherence of the conjunctiva, eyelids and 3rd eyelid. Additionally, centralizing the eyeball allowed the cornea to be parallel to the microscope objective, facilitating adhesive application on the lesions.

After adhesive application, it is recommended to protect the cornea to prevent displacement of the adhesive and reduce ocular discomfort [15]. In animals, the 2 most employed options are therapeutic contact lenses and covering with the 3rd eyelid [15]. In the present case, covering with the 3rd eyelid was chosen for corneal protection, thus avoiding friction between the eyelids and the adhesive. One disadvantage of this procedure is the inability to monitor the progression due to the cornea being covered [4]. Since the patient in the reported case had multiple corneal ulcers, it was likely that the contact lens would not adhere well to the cornea. For this reason, in the current case, the choice was made to cover the eye with the 3rd eyelid.

No complications were observed after adhesive application in the reported case. In this case, the treatment of the ulcers was successful. Besides maintaining the integrity of the eyeball, the adhesive served as a support for healing. The patient maintained visual function with a transparent cornea. The application of n-butyl-2-cyanoacrylate adhesive proved to be a safe, simple and effective method for the treatment of deep corneal ulcers in a cat.

MANUFACTURERS

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***Declaration of interest*.** The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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