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Bilateral blindness in a cat after a dental procedure, suspected to be due to segmental chorioretinal ischaemia necrosis

Cleo Guerreiro, Christine Heinrich and Karen Walsh

Abstract

Case summary A 5-year-old female spayed domestic shorthair cat presented for sudden onset vision loss 3 days after a dental procedure. Bilateral blindness was confirmed on ocular examination, with fundoscopy revealing segmental wedge-shaped areas of retinal oedema and partial non-rhegmatogenous retinal detachments. An initial differential diagnosis included angioinvasive pulmonary carcinoma, based on previously reported fundoscopy images of this condition; however, general physical examination, blood pressure and chest radiographs were all normal. Four weeks after initial presentation, fundoscopy revealed the resolution of the retinal detachments; however, bilateral segmental chorioretinal necrosis was present. The cat regained some vision and remained well 13 months after the initial presentation. Considering the clinical findings, the onset of blindness after a lengthy dental procedure and improvement of vision over time, a diagnosis of pulmonary carcinoma was unlikely and instead a diagnosis of chorioretinal ischaemia secondary to maxillary artery blood flow restriction is proposed.

Relevance and novel information Maxillary artery blood flow restriction has been well documented with varying degrees of jaw opening in cats. Presumed central blindness as a result of this blood flow restriction has also been documented. However, to the authors' knowledge, vision loss due to retinal changes, documented by fundoscopic images and their progression over time following suspected chorioretinal ischaemia after a dental procedure, have not previously been reported. We propose that temporary occlusion of the maxillary artery can result in segmental chorioretinal necrosis and associated blindness in cats. This finding further supports the recommendation to minimise prolonged jaw opening during surgical procedures in cats.

Keywords: Dental; blindness; retina; retinal ischaemia

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Introduction

Ophthalmic complications after dental procedures have frequently been reported in the veterinary literature and include globe penetration,[1,2] endogenous endophthalmitis[3] and blindness.[4] Specifically, blindness after dental procedures has previously been reported in association with the use of spring-loaded mouth gags; however, these cases were not associated with abnormal findings on fundoscopy, and a central insult was proposed as the cause of vision loss.[4] Segmental chorioretinal necrosis has also previously been reported in association with angioinvasive pulmonary carcinoma.[5] To the authors' knowledge, this is the first report of suspected ischaemia chorioretinal necrosis causing acute blindness after a lengthy dental procedure with photographically documented fundoscopic abnormalities.

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Case description

A small 5-year-old female spayed domestic shorthair cat, weighing 3.5 kg, had a dental procedure performed by her general practitioner. Preoperative haematology and biochemistry were within normal limits.

The patient was premedicated with medetomidine (12 µg/kg IM) and methadone (0.3 mg/kg IM) and induced with intravenous (IV) propofol to effect. General anaesthesia was maintained with isoflurane in a carrier gas of 100% oxygen via a Jackson Rees Modified Ayres T-piece. A left-sided maxillary nerve block was performed with 2% lidocaine (0.1 ml). A routine scale and polish was performed and two teeth were extracted (208 and 307). The procedure, which had a duration of 2 h, was performed without a mouth gag. Blood pressure during anaesthesia was within acceptable limits (mean blood pressure was in the range of 66–108 mmHg). Recovery was uneventful. Meloxicam (0.2 mg/kg SC) was administered on recovery. The patient was discharged with meloxicam (0.05 mg/kg PO q24h) and amoxicillin clavulanic acid (14 mg/kg of amoxicillin q12h). Three days after the dental procedure, the owner noticed bilateral mydriasis with altered behaviour suggestive of blindness. At this stage, referral to an ophthalmologist was sought.

A neuro-ophthalmic examination revealed bilateral mydriasis and absent direct and indirect pupillary light responses (PLRs). Colorimetric PLR testing to bright red and blue light were also absent as were dazzle and menace responses. Fundoscopy showed non-rhegmatogenous ventral retinal detachments in the non-tapetal area. In the tapetal region, there were several wedge-shaped areas, radiating out from the optic nerve head, of white-grey subretinal effusions associated with flat retinal detachments (Figure 1). The regions in between the infiltrated areas appeared hyperreflective. The remainder of the ophthalmic examination was unremarkable.

The general physical examination was within normal limits. The patient's systemic blood pressure was measured and was within normal limits (126/88 mmHg measured by oscillometric method on the forelimb). Thoracic radiographs (left and right lateral and dorsoventral) were performed and did not reveal any abnormalities.

Four weeks after initial presentation, the cat was re-examined and the owner reported it had regained some vision. A neuro-ophthalmic examination revealed normal menace responses and dazzle reflexes in both eyes, with partial PLRs to white light. Fundoscopy showed that the previously observed oedematous/infiltrated wedge-shaped areas in the tapetal region had completely atrophied and were now replaced with darkly pigmented areas (Figure 2). The surrounding tapetal areas remained subtly hyper-reflective. In the non-tapetal regions, the previously noted retinal detachments had reattached, and there were only subtle focal areas of depigmentation. The remainder of the ophthalmic examination was unremarkable. The cat's systemic blood pressure remained within normal limits (mean 149/108 mmHg with oscillometric measurement). Approximately 13 months after initial presentation, the examination remained unchanged, the owner described no further deterioration in vision and the fundoscopic findings were stable (Figure 3).

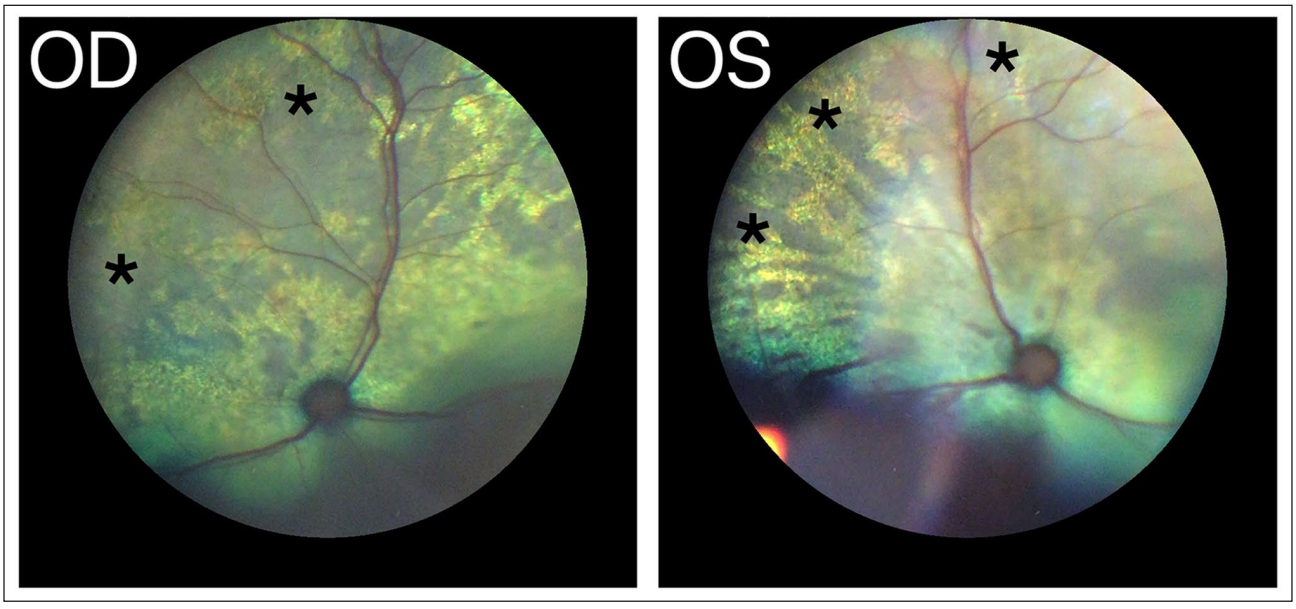

Figure 1 Fundoscopic photographs of the left (OS) and right (OD) eyes 3 days after dental procedure. Note the wedge-shaped areas of white-grey subretinal effusions (*). Taken with the Optibrand ClearView Handheld Digital Fundus Camera with an iPhone

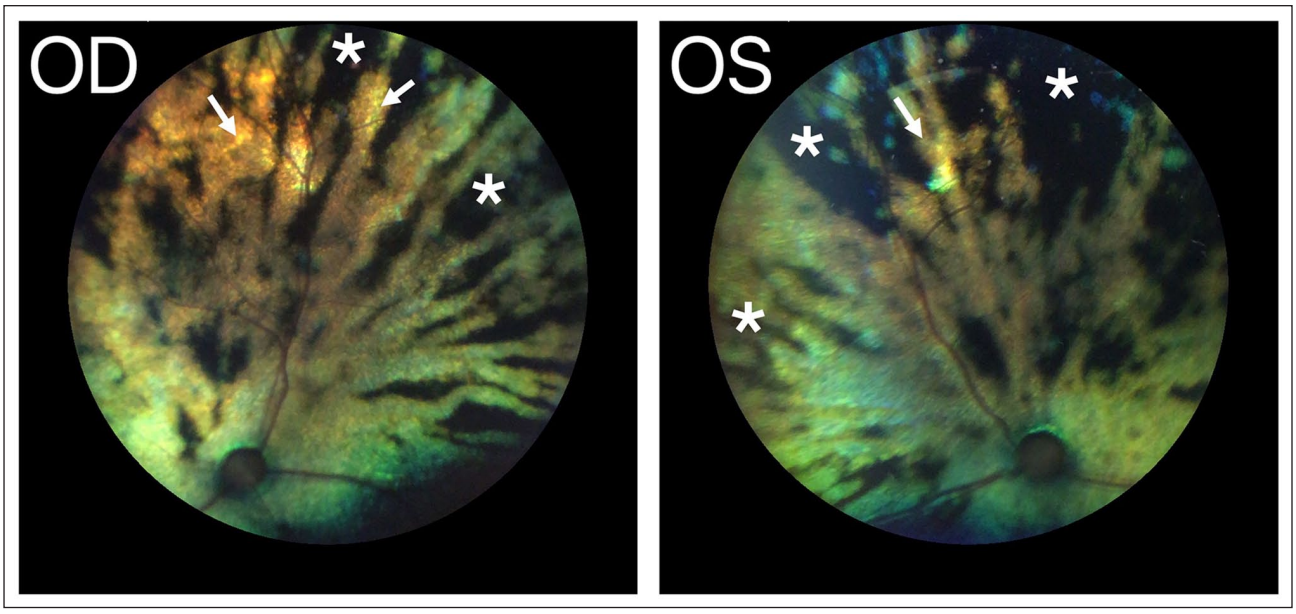

Figure 2 Fundoscopic photographs of the right (OD) and left (OS) eyes 4 weeks after dental procedure. Note the darkly pigmented areas of presumed atrophy (*) with surrounding hyper-reflectivity (arrows). Taken with the Optibrand ClearView Handheld Digital Fundus Camera with an iPhone

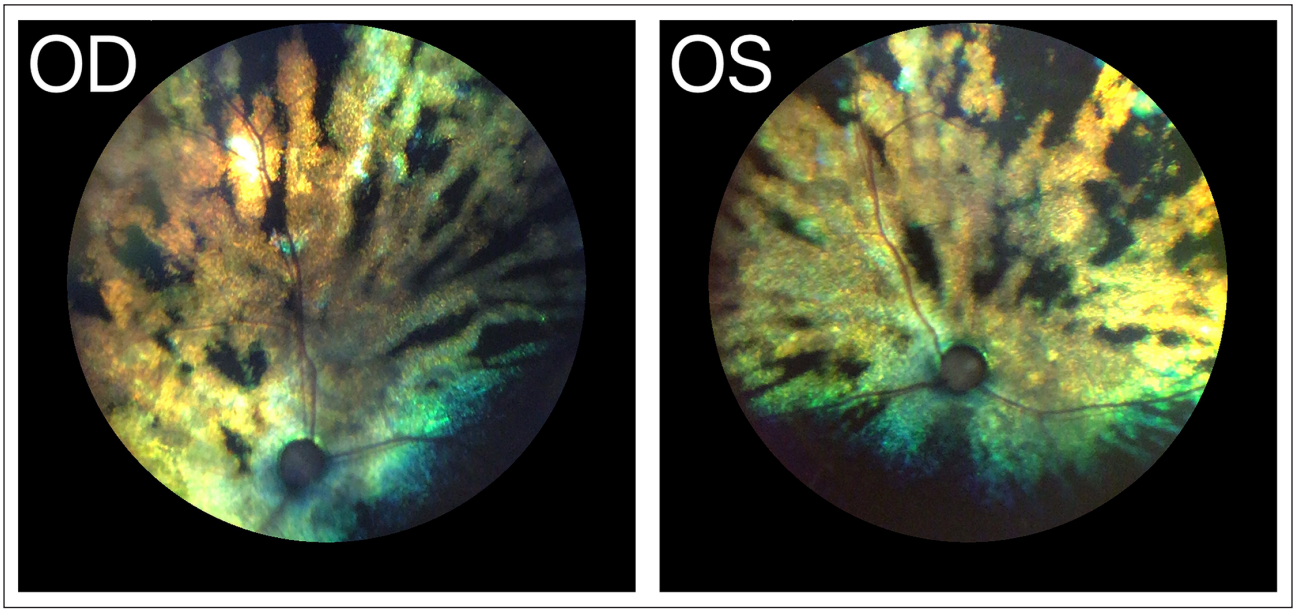

Figure 3 Fundoscopic photographs of the right (OD) and left (OS) eyes 13 months after dental procedure. Note no further deterioration in fundoscopic findings. Taken with the Optibrand ClearView Handheld Digital Fundus Camera with an iPhone

Discussion

Here we present a case of segmental retinal oedema followed by changes commensurate with chorioretinal necrosis after a dental procedure. The retinal findings upon initial presentation of this case (wedge-shaped retinal oedema) and the progression of these lesions 4 weeks after presentation (large wedge-shaped discoloured areas of chorioretinal necrosis in place of the retinal oedema) correspond almost identically to cases of angioinvasive pulmonary carcinoma reported in the literature.[5] In that paper, four cats presented with thoracic masses, mass-like lesions on the digits or limbs, and ophthalmic pathology as above.[5] All four patients were euthanased or died within 6 weeks owing to the aggressive and progressive nature of the disease. Fluorescein angiography or histopathology suggested that the

observed wedge-shaped retinal necrosis in their cases was secondary to neoplastic emboli or thrombi to the chorioretinal arteries. Pulmonary carcinoma is considered an aggressive neoplasia, most commonly seen in older cats.[6] In the current case, although ophthalmic pathology was identical to that of the angioinvasive pulmonary carcinoma cases, our patient was a young cat without concurrent clinical signs suggestive of pulmonary carcinoma (digital/limb masses, respiratory signs, etc). Thoracic radiographs were performed and excluded the presence of visible thoracic masses. The cat was followed up at 4 months and 13 months after the initial presentation and was well and adjusting to its new limited vision, which would be extremely unlikely in a case of angioinvasive pulmonary carcinoma as all those reported cases in previous reports died or were euthanased within 6 weeks of diagnosis.[5] We therefore considered this differential diagnosis unlikely.

Unexpected blindness in cats after general anaesthesia has previously been reported and was initially suspected to be caused by excessive mouth opening when spring-loaded mouth gags were used.[4,7–9] Cadaver dissections initially suggested that wide opening of the mouth, as in the case of spring-loaded mouth gags, may reduce blood flow to the brain through the maxillary artery by stretching of the vasculature and/or cause vascular compression by adjacent soft tissues, thus causing a central blindness.[4] In the present case, central blindness was considered unlikely as there were no accompanying neurological deficits, as seen in the majority of cases previously reported to have central blindness after maxillary artery compression.[4] In addition, if central blindness was present, an intact PLR would be expected, which was not the case here. The significant fundoscopic abnormalities were instead deemed to be the likely cause of the blindness.

Most of the arterial supply to the globe arises from the maxillary artery.[10,11] In the cat, each maxillary artery continues rostrodorsally in an S-shaped curve and immediately downstream forms a fine network of vessels (rete). Arising from this rete, the ophthalmic artery further bifurcates into the long posterior ciliary arteries. Both the ophthalmic and the long posterior ciliary arteries send branches to the distal portion of the optic nerve to form an annulus around it. This annulus is the source of blood supply for the retina and the choroid.[11]

Blood flow through the maxillary artery has been assessed in cats with various degrees of mouth opening in a series of studies.[7–9] Investigations using a combination of CT, MRI and electroretinography (ERG) showed that in a subset of cats, maxillary artery blood flow was altered when the mouth was opened maximally.[7] ERG findings in that paper suggested there was reduced blood flow to the retinas during mouth opening. As such, the authors postulated that because retinal perfusion comes mainly from the maxillary artery, the abnormal ERG findings may be caused by retinal ischaemia, and thus cause post-anaesthetic blindness in these eyes.

This reduction in blood flow through the maxillary artery was then shown to be caused by the narrowing of the space between the medial aspect of the angular process of the mandible and the rostrolateral border of the ipsilateral tympanic bulla when the mouth is open.[9]

In a later study, different mouth opening degrees were assessed to determine if there was an optimal opening that would not compromise the maxillary vascular flow.[8] The study showed that even submaximal opening of the mouth affected blood flow through the maxillary arteries in some cats, and they postulated that smaller cats may be at risk of compromised maxillary artery blood flow even with small mouth gags because of their smaller maximal mouth opening relative to the mouth gag.

Taking the information from the multiple studies above,[7–9] it becomes apparent that the development of blindness after procedures under anaesthesia that involve opening of the mouth is likely to be multifactorial. Factors such as the degree, extent and duration of mouth opening, anatomical variations in the vascular blood supply to the eye and brain among cats, blood pressure and oxygen levels during anaesthesia, and even the size of the patient may all contribute to ischaemia events that could compromise vision.

In the present case, although the use of a mouth gag was not reported, the patient was in fact small, and the dental procedure, which likely required prolonged episodes of mouth opening, lasted 2 h. As such, we postulate that there may have been a significant degree, and duration, of mouth opening in our patient during the dental procedure, which could have led to restricted blood flow through the maxillary artery and secondary chorioretinal ischaemia. Reperfusion after recovery from the dental procedure was presumed to be the reason the chorioretinal lesions did not progress, and the cat eventually regained some limited vision.

Conclusions

In the case reported here, the initial presentation was compatible with blindness due to chorioretinal ischaemia. Angioinvasive pulmonary carcinoma was suspected based on the similarity to previously reported fundoscopy images of this condition. However, the absence of concurrent limb or respiratory pathology and the patient improvement over time made a diagnosis of angioinvasive pulmonary carcinoma unlikely. The timing of the blindness after a lengthy dental procedure in a small cat is more compatible with chorioretinal ischaemia secondary to maxillary artery blood flow restriction.

To the authors' knowledge, fundoscopic images and their progression over time following suspected chorioretinal ischaemia after a dental procedure have not previously been reported. The fundoscopic findings in this case are very striking and may serve as confirmation of chorioretinal ischaemia after prolonged mouth opening, which has previously been lacking in the literature. Maxillary artery obstruction presents as an important differential for fundoscopic changes like the ones presented in this paper and should be considered as a cause for blindness.

Conflict of interest The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethical approval The work described in this manuscript involved the use of non-experimental (owned or unowned) animals. Established internationally recognised high standards ('best practice') of veterinary clinical care for the individual patient were always followed and/or this work involved the use of cadavers. Ethical approval from a committee was therefore not specifically required for publication in *JFMS Open Reports*. Although not required, where ethical approval was still obtained, it is stated in the manuscript.

Informed consent Informed consent (verbal or written) was obtained from the owner or legal custodian of all animal(s) described in this work (experimental or non-experimental animals, including cadavers, tissues and samples) for all procedure(s) undertaken (prospective or retrospective studies).

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