

# USE OF TARSORRAPHY IN ZOO PRACTICE

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## Abstract

Dealing with traumatic corneal ulcer in zoo animals, topical care is often limited or prohibited by restraint management. Tarsorrhaphy stands as an alternative to local care. This single surgical procedure was used with success on several corneal damages in eight different species of Paris Zoo, including seven herbivores and one prosimian. One technique meeting field conditions is described here. Healing timeframe was variable but each case ended with complete healing of the cornea and vision recovery.

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**Key Words:** Tarsorrhaphy, corneal ulcer, ophthalmology, hoofstock, lemur

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## Introduction

Corneal damages are commonly reported in captive wild animals. Captivity may increase this risk by various means : exposure to chemical compounds (e.g chloramines) (STOSKOPF and HIRST L.W, 1982 ), direct or indirect trauma due to conspecific or facility design items. Basic usual topical care in domestic animals includes repeated collyre instillations and ophthalmic ointment applied several times a day (LAFORGE, 1997). Such options are limited in wild animals because of restraint considerations. Used in both veterinary (GELLAT and GELLAT, 1994) and human medicine (PAKARINEN et al, 1987), tarsorrhaphy is an alternative choice to consider in corneal damages of wild animals.

## Method

### 1. Animals

Over 8 years of practice, tarsorrhaphy was performed in 9 different species of Paris Zoo, on 10 different individuals.

Species	Age	Sex	Molecules used to perform tarsorrhaphy <sup>(1)</sup>	Tarsorrhaphy(ies) lasts for	Note
Beisa Oryx <i>Oryx gazella beisa</i>	7y	F	X + E	21 days	Blepharorrhaphy added, lasted 10 days.
Tammar Wallaby <i>Macropus eugenii</i>	14y	F	I	10 days + 7 days	Blepharorrhaphy as third eyelid is atrophied
Axis deer <i>Axis Axis</i>	7y	M	X + K	15 days	
Reindeer <i>Rangifer tarandus</i>	9y	M	X + K	5 days	Animal euthanased because of severe otitis
Blackbuck <i>Antilope cervicapra</i>	1.5y	M	M + K + I	15 days + 21 days + 21 days	
Pigmy goat <i>Capra hircus</i>	8y	F	X + K	11 days	
	9y	F	X + K	15 days	
Okapi <i>Okapia johnsoni</i>	3.5y	M	M + K + I	22 days	
Sitatunga <i>Tragelaphus spekkei</i>	4y	M	X + E	5 days	Euthanasia because of limb trauma damage at D+5days
Crowned Sifaka <i>Propithecus verreauxi</i>	16y	F	I	11 days	Exposure keratitis secondary to exophthalmia. Blepharorrhaphy added

**Table I : Species treated with a tarsorrhaphy procedure at Paris Zoo**

<sup>(1)</sup>Anesthetic molecules are : (E)torphine, (X)ylazine, (K)etamine, (M)edetomidine and (I)soflurane. Isoflurane always provided through endotracheal tube.

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## **2. Anesthesia**

Tarsorrhaphy procedure requires a very still animal, especially without any residual corneal reflex or any other eye blink that could lead to cornea injury during surgery. Therefore, deep anesthetic stage is mandatory for at least 10 minutes of surgery (i.e. anesthetic stage 3-2 or 3-3).

Alpha2 agonists : xylazine (Rompun®, Bayer Animal Health, Puteaux, France) or medetomidine (Domitor®, Pfizer ) plus a dissociative agent (kétamine (Imalgène®, Merial, Lyon, France)) were used with most of hoofstock cases. When sufficient stage was not reached, a surplus of intravenous ketamine was provided right before surgical time.

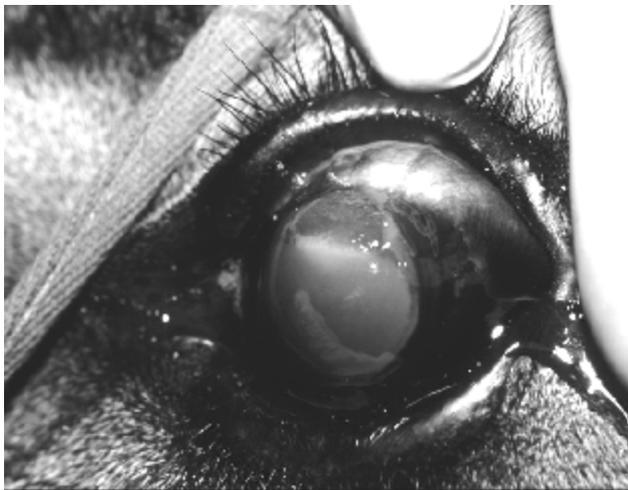
The sifaka was induced and maintained with Isoflurane only.

All animals were monitored through pulse oxymeter (Nonin 9847V, Nonin Medical, Plymouth, MN, USA) or complete anesthesia monitoring device. (Lifescop BSM2351, Nihon Kodhen, Cachan, France)

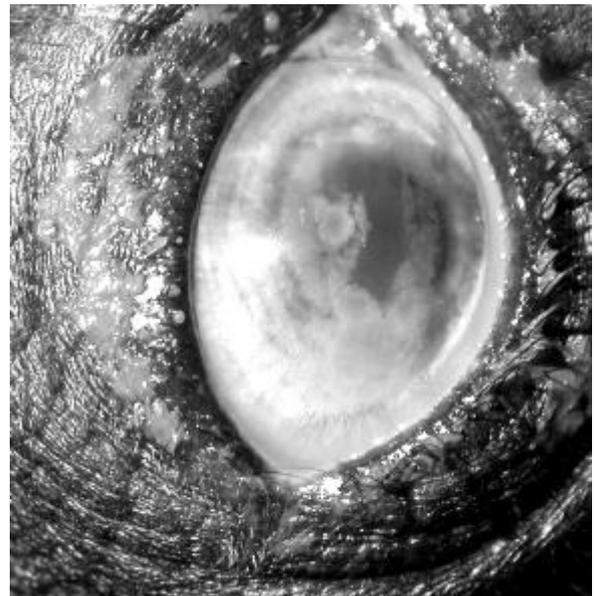
## **3. Diagnostic**

Epiphora and blepharospasm were the common distant signs noticed in every case. Anesthesia decision was triggered by global worsening of these signs, sometimes associated with overextension of neovascularization corneal patches and anorexia related to pain.

As previously described (LAFORGE, 1997), fluorescein test was the main diagnostic tool : eye is flushed with sterile saline solution, and few drops of fluorescein (Fluoresceine 0.5% Unidose, TVM, Paris, France) are poured on cornea. Results of fluorescein uptake were read after a second light saline flush. Best results are obtained under U.V illumination lamp when available.



**Figure 1.** Corneal ulcer in a male Okapi (*Okapia johnsoni*). Corneal neovascularization extending from corneal limbus.



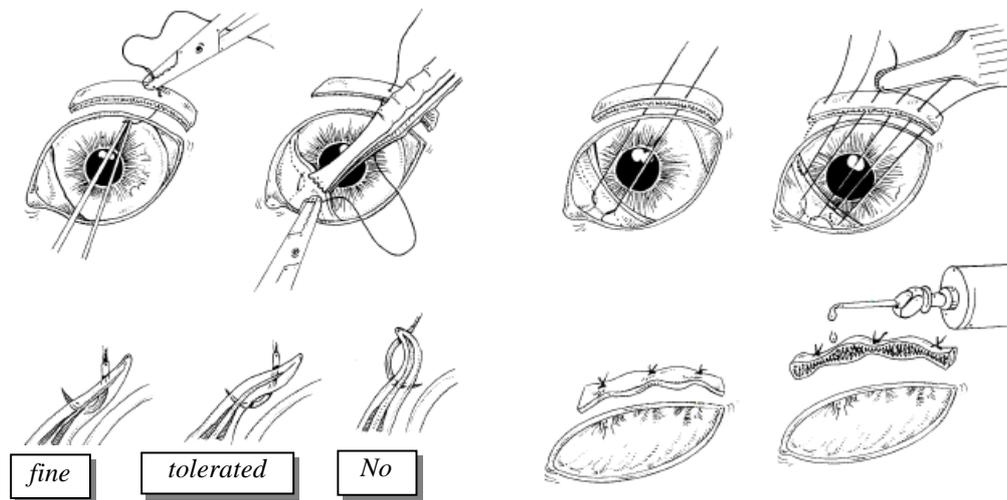
**Figure 2.** Exposure keratitis in a sifaka.

## **4. Surgical procedure**

Eyelids are cleaned then disinfected with a 10% polyvidone iodine solution while cornea is protected by a cap. If needed, surrounding hairs can be shaved carefully, avoiding eventual whiskers. Conjunctival mucosa and cornea are then flushed with 1% polyvidone iodine solution and rinsed with sterile saline. (BOUHANNA, 2001)

*Membrana nictitans* is pulled dorsally with a soft blunt tweezer. Suture (decimal 1 to 2) is passed through a sterile plastic bit (plastic perfusion collector tube), through upper eyelid and then into the third eyelid, around the inner cartilage. The cartilage is not always in “T”-shape as in carnivores, sometimes more like a crescent (tragelaphinae). Anyway, it always stands as reliable anchoring for the suture.

The suture then returns into the upper eyelid and through the plastic. Knots are tied only when all sutures are set. Gentle pressure is applied, not to hurt the eyelid. The plastic tube acts as a cushion to avoid pressure and ischemia of upper eyelid. Then, surgical glue could be added on knots.



**Figure 3.** Technique used, from [SCHMIDT-MORAND,1996]



**Figure 4.** Tarsorrhaphy in a blackbuck (*Antilope cervicapra*)

In two cases (Beisa oryx and sifakas), a blepharorrhaphy was added to strengthen the procedure. The tammar wallaby’s nictitans was not able to be pulled (likely due to old fibrotic scar) and then blepharorrhaphy was used alone.

### **5.Ancillary treatment**

Topical treatment was done during the surgical procedure by placing a canula behind the sutured *membrana nictitans* and applying large amounts of Vitamin A and antibiotic (neomycin, chloramphenicol or ciprofloxacin) ophthalmic ointment beneath. Additional systemic antibiotics was sometime used as well. Especially, the blepharorraphy of the tammar wallaby got infected under topically delivered antibiotics, so that use of systemic ones was needed for the second session.

For every cases, NSAID systemic session was initiated during the first 3 or 4 days post surgery. The goal was to reduce inflammatory condition of the *membrana nictitans* due to surgical handling, needle and stitches. Except for the sifaka, meloxicam (0.1 mg/kg IM sid) or flunixin (2 mg/kg IM sid for 3 days) were delivered by hand or dart injection. The sifaka received ibuprofen orally at 10mg/kg bid.



**Figure 5.** Ointments pulled behind tarsorrhaphy

### **Results**

- On most of the cases, tarsorrhaphy wasn't left more than 3 weeks. Removal was done under anesthesia in a more superficial stage than required for surgery. Control was done with fluorescein test and sometimes still lamp exam. Except from the blackbuck, every corneal defects were healed at the time of control, or at least did not need tarsorrhaphy anymore to end healing process. White scar on previous ulcer site remained for weeks before corneal layer become translucent again .
- The blackbuck required 3 different procedures. The first 15 days were not enough for a complete healing and signs came back within days after removal of first tarsorrhaphy (HEISSAT et al , 2005).
- The tolerance to suture and closure was fine for every animals, with no infection or pruritis noticed. The sifaka used its hand to rub it sometimes, but not to remove it. Even with tarsorrhaphies lasting for more than 20 days, no third eyelid tearing or damages ever occurred.

### **Discussion**

- The technique chosen here is the fixation of third eyelid on upper conjunctival fornix. Alternative techniques -like fixation on dorsal episclera- are more delicate and needs a precise assessment of anchor depth in episclera in order to be tied enough and harmless to conjunctiva.
- Multifilament sutures (Polyglactin ( Vicryl, Janssen, Issy les Moulineaux, France)) were used, diameter ranging from 3-0 to 2-0. But considering infections risks of braid items, a monofilament but still absorbable suture (e.g Polydioxanon) would be a better choice, even Nylon. Absorbability was chosen because it leaves a chance for avoiding second anesthesia.

- Development of an infection beneath the tarsorrhaphy is the main risk of this procedure, as it remains hidden to distant observation. Therefore, corneal sampling with a cytobrush could be helpful to check what kind of flora eye harbors. Anyway, infections occurrence is actually rare both in carnivore and zoo practice.
- This procedure requires a deep anesthetic stage during surgery. Moreover, handling of eye and its annexes could promote an oculovagal reflex (ARNOLD et al, 1994) and could lead to dramatic transient bradychardia. Therefore, anesthesia monitoring –at least cardiac- is strongly advised at the moment of surgery.
- A timeframe of 2 to 3 weeks seems to be enough to speed up healing process. In human care, time ranges from 1 week to 16 months to heal dry eye, lagophthalmia or ulcer. The lack of close monitoring and daily cleaning of tarsorrhaphy prevents to leave it for more than 3 to 4 weeks in zoo practice.
- Even if the prosimian coped well its sutures for more than a week, tarsorrhaphy can't be recommended in non human primates because of eyelid self handling and injury hazards.

## Conclusion

Tarsorrhaphy stands as a valuable tool for zoo practice to manage corneal damages without repeated restraint; it speeds up corneal healing process and relieves pain by withdrawing eye exposure. As long as they can't handle sutures, zoos inhabitants could be good subjects for this procedure. Moreover, it's a very convenient background for more heavy procedures such as conjunctival grafts (ESSON D.W et al, 2006; GIONFRIDDO and POWEL, 2005).

Hazardous fate of corneal ulcer getting chronic like chronic keratitis and keratomalacia, added to algic signs (anorexia,..) related to it are often hard to cope with in zoo animals (GANDOLF et al, 1999). Early use of simple procedure as tarsorrhaphy could sometimes save a lot of time and avoid these detrimental occurrences.

## References

- GANDOLF AR, WILLIS AM, BLUMER ES, AND ATKINSON VMD (1999). Management of melting corneal ulcer in a greater one-horned rhinoceros (*Rhinoceros unicornis*). Proc.Am.Assoc.Zoo.Vet., 111-112
- STOSKOPF M.K., HIRST L.W. (1982) Examination of the Anterior segment of the pinniped eye. Proceeding of AAZV Meeting; 64-68
- GIONFRIDDO J.R, POWEL C.C. (2005). Primary closure of the cornea of two Great Horned Owls (GHO) after resection of nonhealing ulcer. Vet. Ophthalm, **8**. 444
- ESSON D.W, WELLEHAN F.X., LAFORTUNE M, VALVERDE A., CITINO S.B. (2006). Surgical management of a malacic corneal ulcer in a greater one-horned Asian rhinoceros (*Rhinoceros unicornis*) using a free island tarsoconjunctival graft. Vet. Ophthalm., **9**, 1, 65-69.
- PAKARINEN M, TERVO T, TARKKANEN A. (1987). Tarsorrhaphy in the treatment of persistent corneal lesions. Acta Ophtalmol. Suppl. **182** , 69-73.
- GELLAT K.N., GELLAT J.P. (1994). Handbook of Small animal ophthalmic surgery. Pergamon ed. 200p.
- BOUHANNA L. (2001). Chirurgie de la membrane nictitante. Le Point Vétérinaire, **220** , 24-31
- ARNOLD RW, GOULD AB, MACKENZIE R, DYER JA, LOW PA. (1994). Lack of global vagal propensity in patients with oculocardiac reflex. Ophthalmology. **101(8)**:1, 347-52
- LAFORGE H. (1997). Ulcères de la cornée. Prat. Med. Chir. Anim. Comp, Spécial ophtalmologie, Octobre 1997, 113-127
- HEISSAT F., LAIDEBEURE S, LECU A. (2005). Traitement d'un ulcère cornéen par tarsorrhaphie chez une Antilope Cervicapre (*Antilope cervicapra*). Prat. Anim. Sauv. Exot. **5.3**, 11-14
- SCHMIDT-MORAND D. (1996) Affections de la glande nictitante de la membrane nictitante et de la conjonctive. Encyclopédie Vétérinaire. Ophtalmologie 2200. Elsevier, Paris. 1996: 18.