Received: 18 October 2022 | Revised: 14 February 2023 | Accepted: 1 March 2023

DOI: 10.1111/vop.13084

ORIGINAL REPORT

WILEY

A combination of modified Kuhnt–Szymanowski and Celsus–Hotz techniques for correction of entropion and overlong lower eyelids in dogs (40 eyes)

Hanna Walter[1] | **Teresa Bilotta**[1] | **Catarina Goncalves**[2] | **Claudia Busse**[1]

[1]Department of Ophthalmology, Small Animal Clinic, University of Veterinary Medicine Hannover Foundation, Hannover, Germany

[2]Dick White Referrals, Station Farm, Six Mile Bottom, Cambridgeshire, UK

Correspondence
Claudia Busse, Department of Ophthalmology, Small Animal Clinic, University of Veterinary Medicine Hannover Foundation, Buenteweg 9, Hannover, Lower Saxony, Germany.
Email: claudia.busse@tiho-hannover.de

Abstract

Purpose: To describe a surgical approach to correct entropion and overlong lower eyelids in dogs by combining the Celsus–Hotz with the modified Kuhnt–Szymanowski technique.

Methods: Medical records of patients undergoing the described surgical procedure were reviewed. A semilunar-shaped piece of lower eyelid was excised and combined with an angled incision at the most lateral aspect of the wound. Adjacent to this incision a skin flap was mobilized to expose the subcutaneous tissue in the ventral aspects. A four-sided wedge resection was used to shorten the lid margin in variable positions. Following closure of the eyelid margin wedge resection, a wedge of equal width was removed from the lateral skin flap. Skin and subcutaneous tissues were closed in a routine fashion.

Results: All surgeries were performed by an ECVO diplomate or resident. The surgery was performed unilaterally in four and bilaterally in 18 dogs. Most common breeds were English Bulldog (n = 7), Saint Bernard (3), Rottweiler (2) and Cane Corso Italiano (2). Median age was 22 months (range 5–100 months). Median follow-up was 30 days (range 9–987 days). A single surgical procedure was sufficient to correct the entropion in 97.5% (39/40) of eyes.

Conclusion: The combination technique described is a suitable surgical procedure to simultaneously correct lower lid entropion and excessive eyelid length, with the added benefits of a stepped wound closure and a flexible lid margin wedge positioning.

KEYWORDS

canine, Celsus–Hotz procedure, entropion, Hotz–Celsus procedure, Kuhnt–Szymanowski technique, overlong lower eyelid

1 | INTRODUCTION

Entropion can be defined as the inversion of all or part of the eyelid margin resulting in contact between the lid margin or outer skin and the cornea and/or bulbar conjunctiva with associated ocular irritation and potential ocular damage.[1,2] Common breeds associated with lateral lower lid entropion due to an oversized palpebral fissure include giant breeds, such as Great Danes, Mastiffs, St. Bernards and Leonbergers.[2–4] Furthermore, the overlong lower eyelid of these patients often results in a central ectropion leading to exposure of the conjunctiva. A crescent-shaped skin resection to correct entropion in humans was described in the first century AD by Celsus and documented by Zeis.[5] Hotz then modified this technique with additional orbicular ocular muscle resection and anchoring to the tarsal plate to create the Celsus-Hotz procedure, currently more commonly referred to as the Hotz–Celsus procedure.[6] The Celsus–Hotz procedure and its modifications are currently the basic surgical techniques for the treatment of most cases of simple conformational entropion in dogs.[1,2] However, if the eyelid length is not shortened in patients with entropion due to overlong lower eyelids, a Celsus–Hotz-type procedure might lead to inadequate apposition of the eyelid margin to the globe resulting in impaired tear film distribution. To overcome this problem Read and Broun combined the Celsus–Hotz technique with a lateral wedge resection for eyelid shortening.[7] Recently Carrozza et al have further modified the technique of Read and Broun[8] by also combining a Celsus–Hotz-technique with a wedge resection, but with the wedge performed at a more central aspect of the lid margin and without adapting the width of the periocular skin below the incision. A variety of other techniques to shorten eyelids have been described.[4] Munger and Carter were the first to describe the use of a modified Kuhnt–Szymanowski technique in dogs as a lid-shortening procedure to correct atonic ectropion.[4,9,10] The different location of the internal and external lid tissue wedge resections resulted in a staggered wound and therefore a reduced risk of wound dehiscence. The present study reports a novel procedure combining a Celsus–Hotz-type technique with a modified Kuhnt–Szymanowski-type technique to correct entropion in patients with overlong eyelids, along with its success rate and associated complications.

2 | MATERIALS AND METHODS

The medical records of dogs that underwent a combined modified Kuhnt–Szymanowski, Celsus–Hotz procedure for the treatment of entropion and overlong lower eyelids at the Department of Ophthalmology at Small Animal Clinic (University of Veterinary Medicine Hannover Foundation, Hanover Germany), Anicura Veterinary Specialists (Hamburg, Germany) and the ophthalmology department at Dick White Referrals (Cambridgeshire, UK) between October 2016 and October 2021 were reviewed. All dogs had a follow-up time of at least 7 days. Data collected for each case included breed, age, gender, affected eye, concurrent ocular disease and surgery, follow-up time, postoperative treatment and complications. All dogs enrolled in the study underwent a complete ophthalmic examination by a board-certified veterinary ophthalmologist (CB) or a resident under supervision of a board-certified veterinary ophthalmologist (CB) consisting of Schirmer Tear Test, neuro-ophthalmic examination, slit-lamp biomicroscopy, rebound tonometry, indirect ophthalmoscopy and a fluorescein test. The degree of entropion correction was assessed after application of different ophthalmic local anesthetics (Small Animal Clinic (University of Veterinary Medicine Hannover Foundation, Hanover Germany), Anicura Veterinary Specialists (Hamburg, Germany): Proxymetacainhydrochloride, 0.5%, Proparacain, URSAPHARM; Oxybuprocaine, 0.4 mg/mL, Conjuncain, Bausch & Lomb; Dick White Referrals (Cambridgeshire, UK): Proxymetacaine Hydrochloride, 0.5%, Minims, Bausch & Lomb) to the cornea and conjunctiva using the "rule of thumb" as previously described.[4] The degree of lower lid-shortening was estimated after everting the inverted lower eyelid to a normal position and drawing it laterally across the lateral canthus to estimate the width of a wedge to remove excess lid length. All surgeries were performed by an ECVO diplomate or resident. Prior to surgery all owners gave written consent to the surgical procedure. Dogs underwent routine premedication and general anesthesia at the discretion of the anesthetist, which was tailored to the individual patient. Once anesthetized, the periocular area was clipped and the skin aseptically prepared with 1:10 diluted povidone solution, while the ocular surface was prepared with 1:50 diluted povidone solution before rinsing with sterile saline. A variety of perioperative systemic antibiotics (amoxicillin and clavulanic acid, cefalexin or marbofloxacin) and nonsteroidal anti-inflammatory drugs (carprofen, meloxicam, paracetamol, firocoxib or robenacoxib) were administered subcutaneously or intravenously at standard dose rates unless contraindicated.

Patients were positioned in sternal or lateral recumbency on the operating table according to the surgeon's preference. The surgical steps are shown in Figures 1 and 2. To correct the entropion using a Celsus–Hotz-type technique, a 15 scalpel blade was used to delineate a semilunar-shaped piece of skin with the straighter of the two incisions parallel and 2–3 mm from the eyelid margin and the more curved incision marking out the

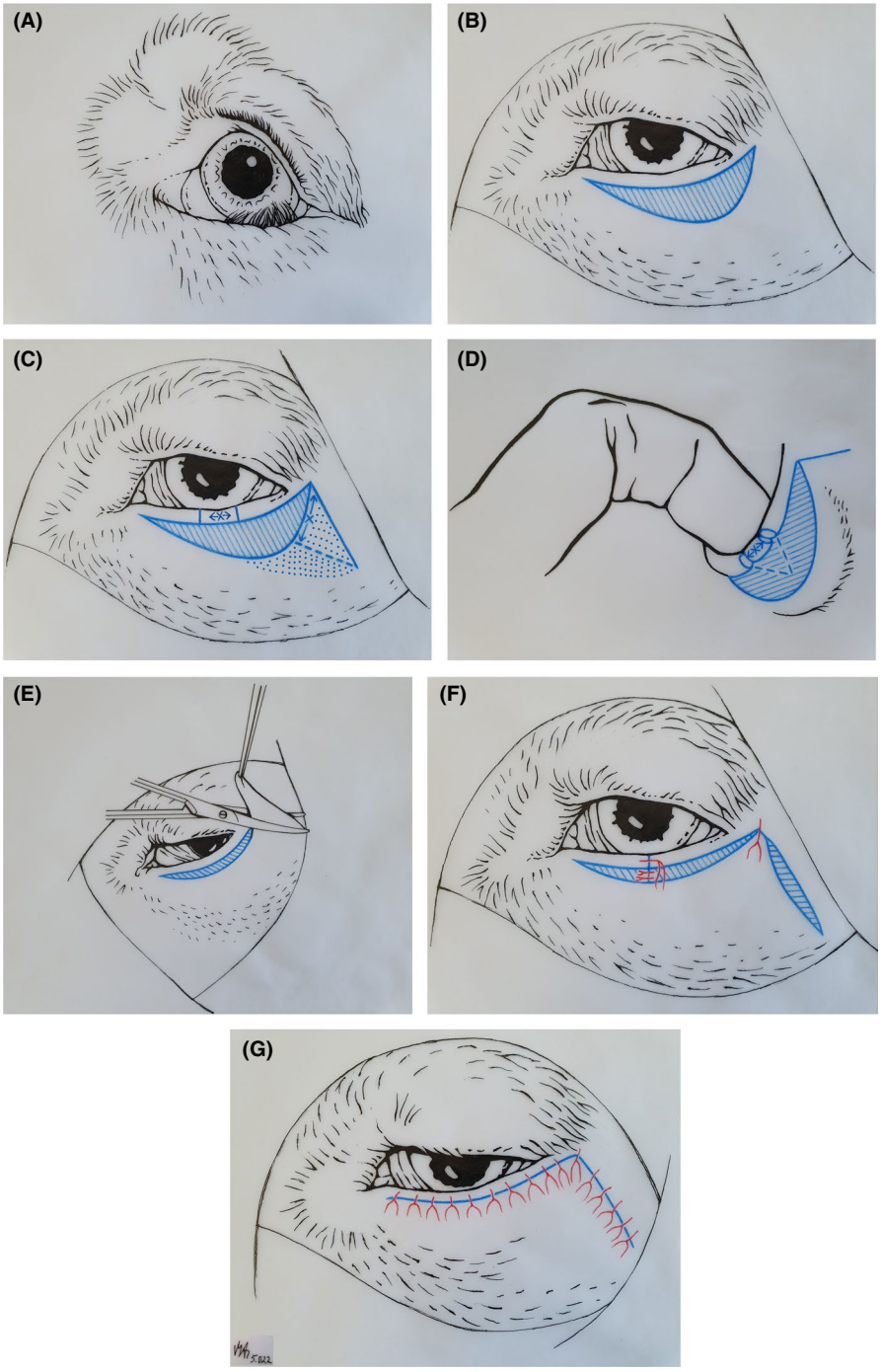

FIGURE 1 (A–G); Illustration of the surgical technique used to correct entropion and overlong lower eyelids. The blue color indicates the incision sites, red color indicates the sutures. (A): Presurgical appearance; (B): A semilunar-shaped skin portion is initially removed to correct the entropion (Celsus–Hotz technique); (C): At the most lateral part of the wound an angled incision is performed and a skin flap is mobilized to expose the subcutaneous tissue, "x" indicates the length of the mobilized skin flap and the length of the wedge resection at the lid margin, the blue dots indicate the area of undermined tissue, the dashed line indicates the lateral wedge resection site; (D): A four-sided wedge resection is used to shorten the lid margin, "x" indicates the length of the resected wedge; (E): An equal amount of tissue is removed from the lateral skin flap; (F): The closure of the wedge resection is performed with a figure of eight and two subcutaneous single interrupted sutures; (G): The skin wound is closed in a routine single interrupted fashion.

degree of lid inversion to be reversed, as determined by the "rule of thumb" (Figures 1B and 2A). The surgeon's index finger and thumb were used to stabilize the eyelid margin during the incisions, after which the delineated skin area was excised. Depending on the anatomical situation of the patient the skin was incised up to the temporal canthus or extended it 5–10 mm laterally, here an additional ventral-running skin incision was performed, and a skin flap was mobilized to expose the subcutaneous tissue (Figures 1C and 2B). A four-sided wedge resection was used to shorten the lid margin in a variety of locations along the eyelid (Figures 1D and 2C). Where patients had a kink in the eyelid margin this was included in the lid margin wedge resection to provide the best lid margin conformation. A wedge of equal width to the lid margin wedge was excised from the lateral aspect of the skin flap (Figures 1E and 2E). The lid margin wedge resection was closed with a "figure of eight" pattern suture at the eyelid margin and additional single interrupted sutures in the subcutaneous edges of the wedge using a 6–0 braided polyglactine 910 suture material (Vicryl, Ethicon; Johnson and Johnson International Diegem, Belgium or LUXCRYL 910, LUXSUTURES, Weiswampach, Luxembourg)

(Figures 1F and 2D). Skin edges were closed with single interrupted sutures of the same suture material. The corner of the skin flap was secured with a suture, then two sutures were placed immediately adjacent to the sutured wedge incision, followed by bisecting sutures as required for adequate skin apposition (Figures 1G and 2F). In a minority of cases (3 eyes), additional tissue adhesive was applied to the lateral aspect of the wound to help seal the skin edges and prevent suture dehiscence. The postoperative appearance before and after suture removal is shown in Figure 3. The pre- and postoperative appearance of patient 15 is shown in Figure 4. The administered post-operative treatment of each patient is shown in Table 2.

3 | RESULTS

The described combined modified Kuhnt–Szymanowski, Celsus–Hotz procedure was performed unilaterally in four dogs (three left and one right eye) and bilaterally in 18 dogs. Most common breeds were English Bulldogs ($n = 7$), St. Bernard (3), Rottweiler (2) and Cane Corso Italiano (2) and one of each of the following: Olde English

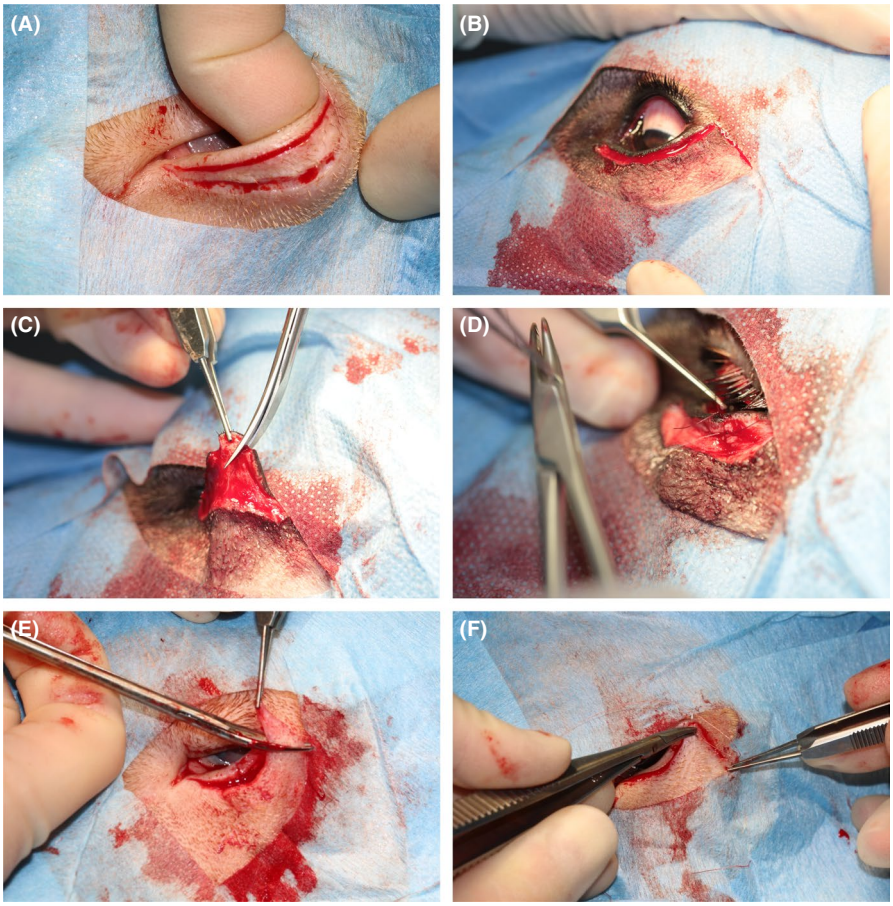

FIGURE 2 (A–F); Photographs of the surgical technique used to correct entropion and overlong lower eyelids. (A): Celsus–Hotz-type technique; (B): Angled incision performed at the most lateral part of the wound; (C): Four-sided wedge resection to shorten the lid; (D): Figure of eight suture and one additional single interrupted suture; (E): Removal of an equal amount of tissue from the lateral skin flap; (F): Skin wound closure in a routine single interrupted fashion.

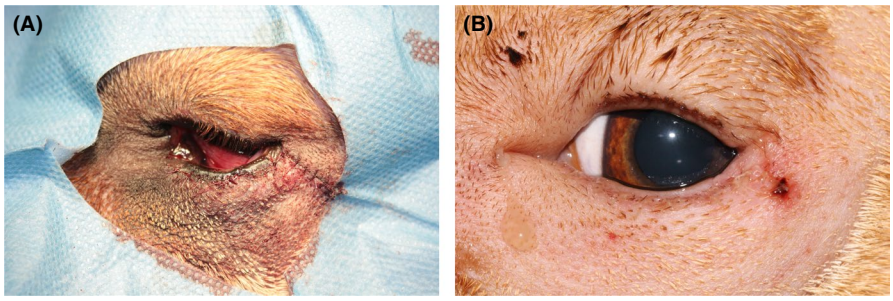

FIGURE 3 (A,B) Photographs, immediately postoperative (A) and 2 weeks postoperative (B). Postoperative treatment was chosen according to the discretion of the surgeon (for details see Table 2). All patients were discharged with an Elizabethan collar, to be worn until the postoperative recheck at seven to 14 days.

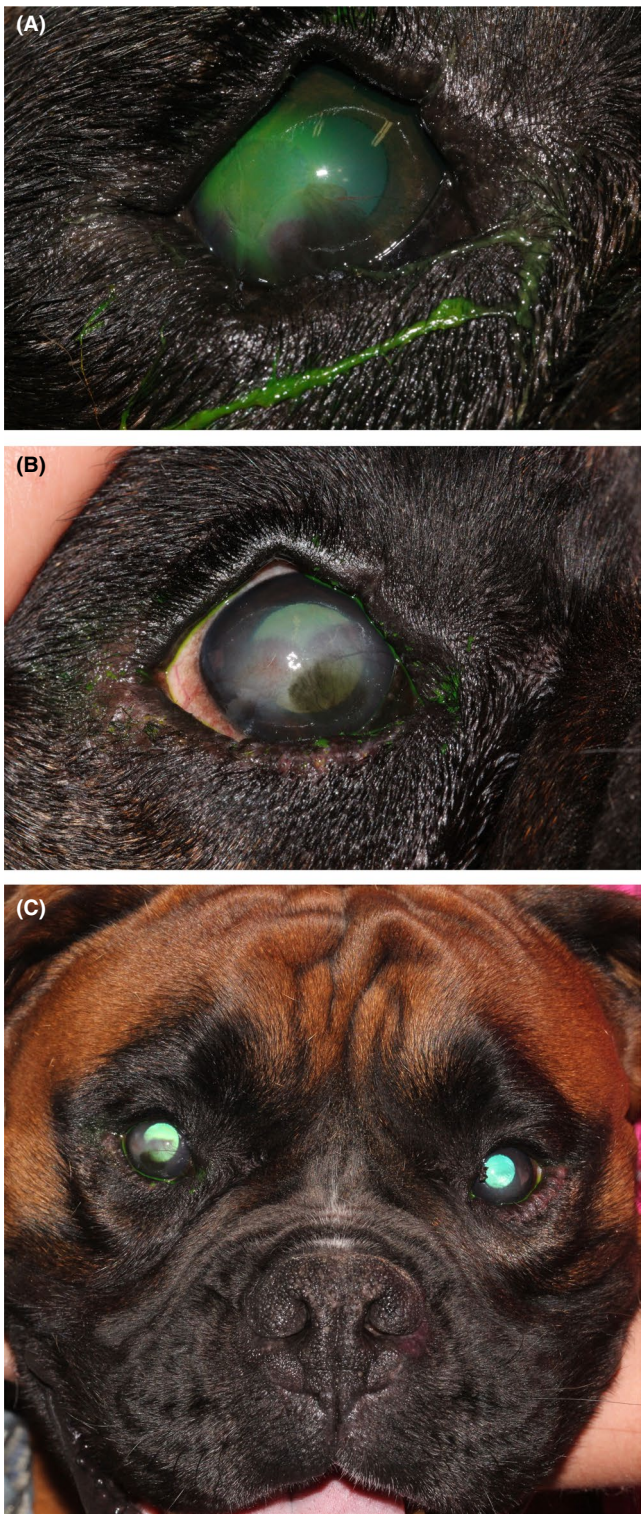

FIGURE 4 (A–C); Pre- and postoperative photographs of patient 15. (A): preoperative appearance, note the lateral entropion, the central kink of the lower lid, entropion-associated superficial ulcer and atypical distichiasis; Appearance of the patient 2 weeks postoperative (B): close-up photograph of the right eye and (C): photograph of both eyes at a wider angle.

Bulldogge, Boxer, Dogo Canario, German wirehaired pointer, Great Swiss Mountain Dog, Kangal, mixed breed and Newfoundland. The median age was 22 months, ranging from 5 to 100 months. Median follow-up time was 30 days with a range from 9 to 987 days. The gender distribution was 58.3% intact males, 25.0% intact females, 8.3% spayed females and 8.3% neutered males. Table 1 shows an overview of the reviewed patients. Table 2 shows an overview of entropion-associated secondary corneal diseases, additional ocular disease, additional performed surgeries, postoperative treatment and outcome.

A single modified Kuhnt–Szymanowski, Celsus–Hotz procedure was sufficient to correct entropion in 97.5% (39/40) eyes. One eye had entropion recurrence after 3 months, requiring a second surgery. Minor complications were wound dehiscence in five eyes affecting the lateral and ventral part of the wound, although none of these patients required a second surgery and all healed well with secondary intention healing. Surgery site infection was presumed in six eyes when discharge and hyperemia of the wound developed at four to seven (average: 5.75) days postoperatively. Signs resolved with a course of systemic antibiotic and additional surgical intervention was not required. Of these eyes, two eyes of the same dog had received additional tissue adhesive on the lateral aspect of the wound, one eye developed a wound dehiscence the other did not. Overcorrection of the eyelid was seen in one eye resulting in mild ectropion which did not interfere with the apposition of the lid margin and was not sufficiently severe to warrant additional surgery. Surgical wounds healed without any postoperative complications in 77.5% (31/40 eyes).

4 | DISCUSSION

Several surgical techniques have been described for the correction of entropion to restore normal eyelid position and therefore function and most importantly ocular comfort.[4,7,8] In this study we describe a modification of surgical techniques by combining the modified Kuhnt–Szymanowski technique with the Celsus–Hotz technique for the correction of entropion and overlong lower eyelids in dogs. An advantage of our technique and the technique of Carrozza and colleagues is that the wedge resection can be tailored to the anatomical situation of the patient. For instance, many of the patients of this study displayed a kink of the eyelid margin (Figure 4A), which could be easily removed with the aid of the wedge resection. The surgical wound at the central aspect of the lid margin may be seen as a disadvantage for ocular surface health. However, if the lid margins are well adapted with a "figure of eight" this should not cause harm to the cornea and none of the patients had corneal alterations at the wedge resection site. A further advantage of the wedge resection at a more central position is that it allows an easier apposition of the wound

TABLE 1 Overview of the reviewed patients.

Patient	Breed	Ages (in months)	Sex	Affected eye(s)	Follow-up time (in days)	Postoperative complications	Tissue adhesive applied
1	Rottweiler	96	m	OU	11	none	no
2	English Bulldog	17	mn	OU	47	OS slightly overcorrected	no
3	English Bulldog	45	f	OU	41	none	no
4	St. Bernard	44	fs	OU	27	none	no
5	Rottweiler	5	m	OU	40	none	no
6	English Bulldog	38	f	OU	34	none	no
7	St. Bernard	27	f	OU	26	OU WD, SSI	no
8	Great Swiss Mt Dog	15	m	OU	194	none	no
9	Cane Corso Italiano	23	f	OU	18	none	no
10	English Bulldog	72	m	OD	92	none	no
11	English Bulldog	11	m	OU	110	none	no
12	Newfoundland	100	fs	OU	9	none	no
13	Mixed breed	13	m	OU	140*	none	no
14	English Bulldog	15	f	OU	25	none	no
15	Boxer	39	mn	OU	987	none	no
16	Cane Corso Italiano	21	m	OU	110	OS WD, SSI	no
17	Kangal	24	m	OU	32	none	no
18	English Bulldog	54	m	OU	168*	none	no
19	St. Bernard	11	m	OU	13	OD WD, OU SSI	yes
20	Olde English Bulldog	11	m	OS	26	none	no
21	German wirehaired point	10	m	OD	24	OD WD, SSI	no
22	Dogo Canario	10	f	OD	19	none	yes

Abbreviations: *, follow-up via telephone; f, female; fs, female spayed; m, male; mn, male neutered; OD, right eye; OS, left eye; OU, both eyes; SSI, surgery site infection; WD, wound dehiscence.

margins since the lid margins have a similar thickness and stability which is helpful for less experienced surgeons. This is in contrast to the technique of Read and Broun which combine the Celsus–Hotz technique with a lateral wedge resection, which results in a complex wound at the lid margin where three wound margins meet. Furthermore, the eyelid margin thicknesses and stability differ. Laterally the eyelid margin is thinner and softer compared to the central aspect, which in the authors experience may lead to difficulties creating a perfect eyelid apposition. A further benefit of the described technique is a stepped wound closure, reducing the risk of wound dehiscence. Additionally, we see an advantage in shortening the eyelid margin and the subjacent skin for optimal eyelid position.

Our technique resulted in a success rate of 97.5% (39/40 eyes) with only one eye requiring a second surgical procedure. With the Read and Broun technique a success rate of 94.2% was achieved in 269 dogs and 42 cats. A second surgery was required in a total of 18 animals.[7] Recently Carrozza et al. have further modified the Read and Broun technique with a success rate of 98.4%, which is comparable to our results,[8] however the study had a higher number of cases ($n = 61$) compared to our study.

In 12.5% (5 of 40) of the eyes of this study a partial suture dehiscence occurred at the most lateral aspect of the wound but was not seen at the wedge resection site. This apparent disadvantage, when compared with results of the other two techniques, might be overcome by greater focus on the suture material used, suturing techniques and antimicrobial prophylaxis versus topical antiseptics. For all patients of this study the suture material utilized was braided, multifilament, resorbable 6–0 (0.7 metric) polyglactin 910 suture material from different brands (Vicryl, Ethicon; Johnson and Johnson International Diegem, Belgium or LUXCRYL 910, LUXSUTURES, Weiswampach, Luxembourg). Suture dehiscence was accompanied by surgery site infection in all patients.

TABLE 2 Overview of the reviewed patients including entropion-associated secondary corneal disease, additional ocular disease, additional performed surgeries, postoperative treatment, entropion recurrence (time in months) and postoperative complications.

Patient	Entropion-associated secondary corneal diseases	Additional ocular diseases	Additional performed surgeries	Postoperative Treatment	Entropion recurrence
1	OS descemetocele	OU enophthalmia due to masticatory myositis, OD iris cyst	OU Stades procedure for upper eyelid entropion OS corneo-conjunctival transposition	Ofloxacin eye drops QID, Cefalexin 25 mg/kg BID po for 14 d, Meloxicam SID for 5 d	none
2	OU superficial ulcer	OS ectopicc cilia, OU upper eyelid distichiasis (soft)	OS extirpation of ectopic cyclia	Carprofen 4 mg/kg po SID	none
3	OS superficial ulcer	OU upper eyelid distichiasis	OS DBD (12 d preOP), OU cryotherapy for distichia, brachiocephalic obstructive airway syndrome surgery	Prednisolon 1 mg/kg SID po for 3 d, Omeprazole 1 mg/kg SID po for 7 d, Amoxiclav 20 mg/kg BID po for 5 d, Paracetamol 10 mg/kg BID po for 3 d	none
4	none	OU allergic conjunctivitis (OS>OD)	none	Meloxicam SID po for 7 d, Amoxiclav 20 mg/kg BID po for 5 d	none
5	OU superficial ulcer	none	none	Isathal BID for 18 d	none
6	OS superficial ulcer OD facette	OU upper eyelid distichiasis	OU cryotherapie for distichia	Isathal BID for 5–7 d, Meloxicam SID po for 7 d, Cefalexin 25 mg/kg BID po for 7 d	none
7	none	OU allergic conjunctivitis, OS upper eyelid distichiasis	none	Meloxicam SID po for 7 d, Amoxiclav 20 mg/kg BID po for 7 d	none
8	OD superficial ulcer	OU lower eyelid distichiasis	none	Meloxicam SID po for 7 d, Amoxiclav 20 mg/kg BID po for 7 d	OD 3 months after 1st surgery
9	OD keratitis	OU lower and upper eyelid distichiasis	OU cryotherapie for distichia in a previous surgery 1 year before entropion	Meloxicam SID po for 10–14 d	none
10	OU keratitis	OS Kerato-conjunctivitis sicca	brachiocephalic obstructive airway syndrome surgery	Marbocyl 2 mg/kg SID po, Optimmune BID OS	none
11	OS fibrosis	OD upper eyelid distichiasis	none	Carprofen 4 mg/kg SID po for 7 d, Amoxiclav 20 mg/kg BID po for 7 d	none
12	OD fibrosis	OS previous retrobulbar abscess, prolapsed nictitating gland (1 month prior to entropion correction)	OS Morgan pocket technique	Firocoxib 5 mg/kg SID po until comfortable, Marbocyl 2 mg/kg SID po for 5 d	none
13	OS superficial ulcer	OU upper eyelid distichiasis	none	Meloxicam SID po for 7 d, Metamizol BID po for 7 d, Trazodon BID po for 7 d	none

TABLE 2 (Continued)

Patient	Entropion-associated secondary corneal diseases	Additional ocular diseases	Additional performed surgeries	Postoperative Treatment	Entropion recurrence
14	OU corneal perforation with iris prolaps	OD upper eyelid distichiasis, OU upper eyelid temporal entropion	OU autologous corneal grafting OD cryotherapie for distichiasis	Chloramphenicol eye drops QID OU, Amoxiclav 20 mg/kg BID po, Carprofen 4 mg/kg SID po until comfortable	none
15	OD superficial ulcer OU fibrosis	OU atypical distichiasis	OD DBD	Chloramphenicol eye drops QID OD, Plasma eye drops QID OD, Amoxiclav 20 mg/kg BID po for 7 d, Robenacoxib 1 mg/kg SID po until comfortable	none
16	OS superficial ulcer	none	none	Meloxicam SID po for 10 d, Amoxiclav BID po for 7 d, Remend eyedrops BID OU for 10 d	none
17	OD superficial ulcer	none	none	Meloxicam SID po for 7 d, Amoxiclav BID po for 5 d, Trazodon up to TID po for 7 d	none
18	OU fibrosis & keratitis	OS upper eyelid entropium	OS upper eyelid Celsus–Hotz technique	Meloxicam SID po for 7 d, Amoxiclav BID po for 7 d	none
19	OD superficial ulcer	none	none	Meloxicam SID po for 7 d, Amoxiclav BID po for 7 d	none
20	OS keratitis	OU distichiasis	OU upper and lower eyelid en-bloc resection of distichiasis	Meloxicam SID po for 7 d	none
21	OS fibrosis	none	none	Meloxicam SID po for 3–5 d	none
22	OD superficial ulcer	none	none	Meloxicam SID po for 3–5 d	none

Abbreviations: BID, bis in die; d, days; DBD, Diamond Burr Debridement; OD, right eye; OS, left eye; OU, both eyes; po, per os; QID, quarter in die; SID, semel in die; TID, ter in die.

The relatively high percentage of surgery site infections (15%, 6 of 40 eyes), could have several reasons. Three out of four patients suffering from surgery site infection were giant or large breed dogs (St. Bernard (2), Cane Corso Italiano (1)), whose heavy and thick skin, was associated with a more difficult postoperative management by the owner and possibly faster resorption of the utilized resorbable suture material, due to wetting of this aspect of the surgical site. Potentially, intraoperative suture material and tissue handling might be a reason for secondary surgical site infection resulting in wound breakdown. Wound breakdown occurred in four eyes of three large breed dogs in the study of Carrozza et al. The authors theorize that the breakdown of the wound could be linked to the resorbable suture material.[8] Complications like wound breakdown or surgical site infections are not mentioned in the study of Read and Broun. Both studies utilize a rapidly hydrolyzing form of 5–0 (1 metric) polyglactin 910 (Vicryl Rapide, Ethicon; Johnson and Johnson International Diegem, Belgium). One reason for the differences in surgical site infection between the studies could be the different utilized suture materials. Therefore, it could be argued that the rapid hydrolyzing form of polyglactin 910 is less prone to wound infection as its rapid hydrolysis gives bacteria less time to wick into the surgery site. Since irradiated polyglactin 910 begins to slough in approximately seven to 10 days[11] and surgical site infection and wound breakdown was seen at four to 7 days postoperatively in this study, it does not seem advantageous to utilize this suture material in future patients. Alternatively, non-resorbable suture material may be advantageous compared to multifilament, resorbable suture material, since there is less wicking, which makes a bacterial colonization of the wound less likely.[12] As the surgery technique evolved further and in an attempt to overcome wound breakdown, tissue adhesive was applied at the most lateral aspect of the wound for its antibacterial property to seal it from bacterial colonization and prevent dehiscence in the latest patients.[13] Tissue adhesive was applied in a total of three eyes, one healed without further complications and one dog developed surgical site infection in both eyes resulting in suture dehiscence in one. Further research is needed to draw conclusions if tissue adhesive is truly beneficial in these patients. Three of four patients suffering from surgical site infection and wound dehiscence received a systemic antibiotic (amoxicillin and clavulanic acid in all cases). Due to the general recommendation to reduce antibiotic use and since the World Health Organization recommends prophylactic postoperative antibiotic use only if dramatic complications are expected,[14] the last three patients in the study did not receive a systemic or topical antibiotic for this reason. In the author's opinion the problem of surgical site infection and wound dehiscence in these patients did not arise from the ocular surface but from the periocular skin, which is not reached with a topical antibiotic. A possible way to reduce colonizing of bacteria on the periocular skin and wound would be to include antiseptic treatment, for instance polyhexanide, for cleaning of the periocular wound and therefore improving the postoperative management of these patients. To improve healing at the angled wound further, a two-layered wound closure could be considered. Alternatively, a deep U-suture could help to stabilize the most lateral corner of the skin flap part of the wound.

Our surgical procedure is slightly more complicated compared to Carrozza's technique which could be challenging for less experienced surgeons. However, in the author's experience usually one to two procedures are sufficient until one is capable to perform this surgical technique. Overall this surgical procedure resulted in a high success rate and a good outcome with only one eye needing a second surgical intervention. Our technique enables to concurrently correct any lower eyelid kink associated with central ectropion and has the benefit of a staggered wound. Limitations of this study are based on its retrospective nature. The follow up time with a minimum of 7 days is rather short but was chosen as point of last consultation following successful surgery. Seven cases had a follow up time of 3 months and in two cases it was greater than 6 months. Therefore, it is possible that later recurrences of entropion or additional ocular alterations might have gone unnoticed. However, this is true for any kind of entropion surgery and a recurrence of the problem is more likely due to further anatomical changes of the patients head and skin rather than reflecting a problem with the surgical technique if the eyelid position was adequate after healing was completed postoperatively. The relatively small sample size in the present study makes direct comparison to the studies of Read and Broun and Carrozza et al. somewhat problematic, as do the different suture materials used, variable use of tissue adhesive and variable post-operative management. Future studies involving the surgical procedure described could look at comparing complication rates between groups where different skin closure materials have been used. Although the lid lengths of patients were not recorded and the size of the wedges were not available in all patients, there is a high variance of the lid length especially in large breeds without ocular disease,[15] making such information of limited use. Tailoring the amount of lid shortening individually to the anatomical needs of each patient is, in the author's opinion, a better approach rather than trying to apply any rigid eyelid length criteria.

5 | CONCLUSION

The surgical procedure combining a Celsus–Hotz technique with a modified Kuhnt–Szymanowski technique, as described in the present study, was highly successful in correcting entropion and overlong eyelids in selected breeds with the advantages of a stepped wound and a flexible lid margin wedge positioning.

ACKNOWLEDGMENTS

The authors thank Caren-Imme von Stemm for creating the surgical drawings of this article. The corresponding author thanks the Anicura Veterinary Specialists Hamburg and Dick White Referrals for use of clinical data. Open Access funding enabled and organized by Projekt DEAL.

CONFLICT OF INTEREST STATEMENT

None of the authors have a financial or personal relationship with other people or organizations that could inappropriately bias the content of the paper.

ORCID

Hanna Walter https://orcid.org/0000-0002-4552-4954
Claudia Busse https://orcid.org/0000-0002-6230-4195

REFERENCES

1. Stades FVDW. A Disease and surgery of the canine eyelid. In: Gelatt KN, Ben-Shlomo G, Gilger BC, Hendrix DVH, Kern TJ, Plummer CE, eds. *Veterinary Ophthalmology*. 6th ed. John Wiley & Sons, Inc; 2021:935-936 938-939:chap 15.
2. Maggs D. Eyelids. In: Maggs DJ, Miller P, Ofri R, eds. *Slatter's Fundamentals of Veterinary Ophthalmology*. 5th ed. Elsevier Saunders; 2013:110-139 chap 6.
3. Guandalini A, Di Girolamo N, Santillo D, et al. Epidemiology of ocular disorders presumed to be inherited in three large Italian dog breeds in Italy. *Vet Ophthalmol*. 2017;20(5):420-426. doi:10.1111/vop.12442
4. Stades FVDW. A Disease and surgery of the canine eyelid. In: Gelatt KN, Ben-Shlomo G, Gilger BC, Hendrix DVH, Kern TJ, Plummer CE, eds. *Veterinary Ophthalmology*. 6th ed. John Wiley & Sons, Inc; 2021:938 chap 15.
5. Zeis E. *Handbuch der plastischen Chirurgie*. Reimer, G; 1839.
6. Hotz F. A new operation for entropion and trichiasis. *Arch Ophthalmol*. 1879;8:249-263.
7. Read RA, Broun HC. Entropion correction in dogs and cats using a combination Hotz-Celsus and lateral eyelid wedge resection: results in 311 eyes. *Vet Ophthalmol*. 2007;10(1):6-11. doi:10.1111/j.1463-5224.2007.00482.x
8. Carrozza R, Lenihan E, Hamzianpour N, et al. Lower lid entropion in dogs: a modified technique of the combined Hotz-Celsus and wedge resection procedure. *Vet Rec*. 2022;190(11):e1383. doi:10.1002/vetr.1383
9. Kuhnt HSJ. Ectropion. In: Fox S, ed. *Ophthalmic Plastic Surgery*. 4th ed. Grune &Stratton; 1976:274-281.
10. Munger R, Carter J. A further modification of the Kuhnt-Szymanowski procedure for correction of atonic ectropion in dogs. *J Am Anim Hosp Assoc*. 1984;20(4):651-656.
11. Tan RHH, Bell R, Dowling B, Dart A. Suture materials: composition and applications in vetern-ary wound repair. *Aust Vet J*. 2003;81(3):140-145.
12. Wilkie D. Fundamentals of ophthalmic microsurgery. In: Gelatt KN, Ben-Shlomo G, Gilger BC, Hendrix DVH, Kern TJ, Plummer CE, eds. *Veterinary Ophthalmology*. 6th ed. Wiley & Sons; 2021:787-814 chap 12.
13. Jenkins LE, Davis LS. Comprehensive review of tissue adhesives. *Dermatol Surg*. 2018;44(11):1367-1372. doi:10.1097/dss.0000000000001576
14. World Health Organization. Global guidelines for the prevention of surgical site infection, second edition; Licence: CC BY-NC-SA 3.0 IGO. 2018.
15. Stades F, Boeve M, Van der Woerdt A. Palpebral fissure length in the dog and cat. *Progress in Veterinary and Comparative Ophthalmology*. 1992;2(4):155-161.

How to cite this article: Walter H, Bilotta T, Goncalves C, Busse C. A combination of modified Kuhnt–Szymanowski and Celsus–Hotz techniques for correction of entropion and overlong lower eyelids in dogs (40 eyes). *Vet Ophthalmol*. 2025;28:114-123. doi:10.1111/vop.13084